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M. Banyer



Mental Improvement:

OR THE

BEAUTIES AND WONDERS

OF

NATURE AND ART.

IN A SERIES OF

INSTRUCTIVE CONVERSATIONS.

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BY PRISCILLA WAKEFIELD,  
AUTHOR OF LEISURE HOURS.

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*FIRST AMERICAN, FROM THE THIRD LONDON EDITION.*  
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NEW-BEDFORD:  
PRINTED BY ABRAHAM SHEARMAN, JUN.  
For CALEB GREENE & SON.

1799.

FRANCIS AND WILHELM

THE LIFE AND REIGN OF

FRANCIS THE FIRST, KING OF FRANCE AND NAVARRY

BY JOHN BOURNE, ESQ. OF THE MIDDLE TEMPLE

IN TWO VOLUMES. THE SECOND VOLUME.

LONDON, Printed and Sold by W. BENTLEY, in Pall-mall; and by J. HODGKINSON, in St. Dunstons Church-yard; 1751.

FRANCIS THE FIRST, KING OF FRANCE AND NAVARRY

BY JOHN BOURNE, ESQ. OF THE MIDDLE TEMPLE

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## P R E F A C E.



THE art of exercising the faculty of thinking and reflecting upon every object that is seen, ought to constitute a material branch of a good education ; but it requires the skill of a master's hand, to lead the minds of youth to the habit of observation. Dr. Watts says, that there are four methods of attaining knowledge. Observation, reading, conversation, and meditation. The first lies within the compass even of children, and from the early dawn of reason, they should be accustomed to observe every thing with attention, that falls under their notice. A judicious instructor will find matter for a lesson among those objects, that are termed common or insignificant. How little this is generally the case, may be collected from the ignorance, not of children only, but sometimes of youth, who, although they have attained a considerable degree of classical learning, are unacquainted either with the materials of those things they daily use, or the methods of manufacturing them. The form and appearance of substances are so much

changed by the effects of art, that it would be impossible for a mind, unprepared by instruction, to conceive the original material of many things, that are in the most common use. Would any child suppose, that the cloth, of which her frock is made, is composed of the fibrous parts of a green plant; or that the paper upon which she draws, is the same substance wrought into a different form; that the transparent glass, out of which she drinks, was once a heap of sand and ashes; or that the ribbon she wears is the produce of an insect? The design of the following little work, is to excite the curiosity of young persons on these subjects, by furnishing information on a few of the most obvious. The form of dialogue has been adopted as best suited to convey instruction blended with amusement; being desirous that it should be read rather from choice than compulsion, and be sought by my young readers as an entertainment, not shunned as a mere dry preceptive lesson.



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**MENTAL IMPROVEMENT.**

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## The Persons.

MR. HARCOURT.

MRS. HARCOURT.

SOPHIA, AGED SIXTEEN.

CECILIA, AGED TWELVE.

AUGUSTA, AN OCCASIONAL VISITER,  
AGED TWELVE.

CHARLES, AGED FIFTEEN.

HENRY, AGED NINE.

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MENTAL IMPROVEMENT;  
IN A SERIES OF  
INSTRUCTIVE CONVERSATIONS.

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CONVERSATION I.

SOPHIA and CECILIA.

*SOPHIA.* **H**OW happy are we, my dear sister, to be blessed with such parents, who devote so much time to our instruction and amusement! with what tenderness do they listen to our conversation, and improve every subject that arises to our advantage!

*CECILIA.* I am never so happy in any other company; they have the art of rendering instruction and study agreeable. Though I tenderly love my governess, I feel such a superior attachment to my mamma, that I am not able to express it; and I am sure Mrs. Selwyn will not blame me for it, for she always advises me to look up to my father and mother as my best and kindest friends.

*SOPHIA.* Mrs. Selwyn our worthy governess, is too wise and discreet to be jealous of our preferring our parents to every body; she would sooner direct us to regulate our affections properly, and undoubtedly give them the first place.

*CECILIA.* What bitter repentance do I feel, when I have done any thing to offend them, particularly when I am inattentive to their instruction! How comes it, Sophia, that I am so often idle, and my

thoughts wander from what I am about, when I really intend to be good ?

*SOPHIA.* You are very young, my dear, and mamma says that the habit of attention is difficult to form ; but that by steadily endeavouring to fix our thoughts on one object we shall every day find it more easy ; and though it may cost us some pains at first, let us remember what we owe to the affectionate care of such a mother, and give our whole attention, when she condescends to instruct us.

*CECILIA.* I often pity poor August ; she has no mamma, and her governess seldom teaches her any thing but her regular lessons.

*SOPHIA.* I both love and pity her ; she is of a good disposition, but has not received the same advantages that we have ; her papa is engaged in business, and leaves her wholly to the care of her governess, who takes but little pains with her.

*CECILIA.* Let us desire our parents to give us leave to invite her often to be present at our evening conversations. Papa has promised to give us some account of various manufactures ; all will be new to her, she will be delighted, and it will be a means of supplying her with some of the instruction she wants.

*SOPHIA.* Mamma will be very willing, I dare say ; she takes pleasure in doing good, and is never better pleased than when she has an opportunity of improving young people.

*CECILIA.* I long for the evening, when we are all to meet in the study. I wonder what will be the subject papa will have prepared for us. My brothers too are to be of the party, and when we have been separated all day, it is such a pleasure to meet them, that I cannot say how delighted I am with the thoughts of it.

*SOPHIA.* It is almost time to attend our writing master, and do not let us forget the terms of admission to these agreeable evening conversations ; attention to our lessons in the day, and obedience to the commands of our dear mamma, are the only methods

of obtaining a seat in the study at night. Papa will not confine the subject of his lectures wholly to manufactures, but intends to explain the nature of the materials of what we wear and use, which will frequently lead him to describe objects of natural history, a study of which I am particularly fond.

*CECILIA.* We are also sometimes to supply a subject, we are to have books given us, that we may be prepared, and are to be questioned on the given subject. I wish I may be able to answer properly.

*SOPHIA.* Hark! the bell rings for writing; we must attend the summons.

## CONVERSATION II.

MR. HARCOURT, MRS. HARCOURT, AUGUSTA, SOPHIA, CECILIA, CHARLES, and HENRY.

*Mrs. HARCOURT.* **M**Y dear Augusta, I am glad to see you; my girls tell me you desire to be of our party, when we meet of an evening. Your company will be always agreeable to me, and I hope our conversations will be instructive to you.

*AUGUSTA.* I accept the invitation with pleasure; but I hope to receive entertainment as well as instruction; for I shall never be able to attend to a long dry lecture, without some amusement to render it palatable.

*Mr. HARCOURT.* I have chosen the Whale for our subject to night, and the information it affords I expect will be new and wonderful to you all.

*CHARLES.* Is not the Whale found in the seas towards the north pole?

*Mr. HARCOURT.* Yes, my dear, they chiefly inhabit the seas towards the north pole; though many whales are caught in the South Seas towards that pole; but the chief fishery has been near the coast of Spitzbergen, Nova Zembla, and Greenland; where many

ships from this country go every year, for the sole purpose of catching whales.

*Mrs. HARCOURT.* We may admire the goodness of Providence, who leaves not the most obscure corner of the globe without its peculiar riches. These countries, which scarcely supply food for their wretched inhabitants, and are covered with snow, full nine months in the year, are visited by people from distant parts of the world, who brave every danger, for the sake of taking the whales, which are found in their seas.

*CECILIA.* I cannot think what use they can be of, to tempt people to go so far for them.

*Mr. HARCOURT.* You will find that they supply several useful articles for our convenience. Your stays, for example, would not be so well shaped without whalebone.

*CECILIA.* Are the bones that stiffen our stays really the bones of whales?

*Mr. HARCOURT.* The substance called whalebone, adheres to the upper jaw, and is formed of thin parallel laminae, called whiskers; some of the longest are four yards in length; they are surrounded by long strong hair, to guard the tongue from being hurt, and also to prevent the return of their food, when they discharge the water out of their mouth.

*HENRY.* Whiskers four yards long! how fierce the whale must look! pray what size is he himself?

*Mr. HARCOURT.* The common whale is the largest of all animals, of whose history we have any certain account; it is sometimes found ninety feet long, and those which inhabit the torrid zone are said to be much larger. The size of the head is about one-third of the whole fish, the under lip is much broader than the upper, which is narrow and oblong, the tongue is a soft, spongy, fat substance, sometimes yielding five or six barrels of oil; the gullet or swallow is very small for so large an animal, not exceeding four inches in width; but that is proportioned to the food it eats, which is a particular kind of small

snail ; or, as some say, it varies its repast with the Medusa, or sea blubber, an insect which is found in the sea.

*SOPHIA.* Is not the whale a fish of prey then ? I thought it would devour men, if they unhappily fell in their way.

*MR. HARCOURT.* They are quite harmless and inoffensive to every thing but insects. The only danger to be apprehended from them, is the starting of a plank in a ship, or the overturning of a boat, with their huge bulk.

*AUGUSTA.* Oh terrible ! what can induce men to incur such dangers, when they may stay quietly at home and enjoy themselves ?

*MRS. HARCOURT.* There are many strong reasons that prevail with thousands to undergo a life of hardship, toil, and danger. The necessity of earning a living, to which you, who are brought up in the enjoyment of plenty, are strangers, is one strong inducement.

*SOPHIA.* But I would chuse some easier employment ; a gardner has an agreeable life.

*MR. HARCOURT.* But do you not reflect that all men cannot be gardeners ; there is employment for but few in that line. Providence has wisely endued mankind with as great a variety of inclinations and pursuits, as there is diversity in their persons ; some shew a very early inclination for a sea-life, that no danger can deter, or persuasions prevail with them to give up ; which appears to be implanted for the purpose of providing the means of an intercourse between the inhabitants of distant countries, by which each party may reap advantage by interchanging the superfluous produce of distant climes, and exercising the mutual good offices of love and kindness. But to return to the whale ; it has two orifices in the middle of the head, through which it spouts water to a great height, and, when it is disturbed or wounded, with a noise like thunder. Its eyes are not larger than those of an ox, and placed at a great distance

from each other. There is no fin on the back, but on the sides, under each eye are two large ones which serve it for rowing. The colour varies, the back of some being red, others black, and another variety is mottled; the belly is generally white. They are extremely beautiful in the water; the skin is very smooth and slippery. Under the skin the whale is covered with fat or blubber, from six to twelve inches thick, which sometimes yields from one to two hundred barrels of oil. All Europe is supplied with oil for lamps, and many other purposes, from this blubber. The flesh is red and coarse, somewhat like beef; the Greenlanders eat it, and the Icelanders soak it in four whey.

*CHARLES.* It must be very disagreeable food. I should think, the oil would make it very greasy and strong.

*Mr. HARCOURT.* So it does: but the poor people, who live in countries so far north, have but little variety of meat to tempt their appetite. In winter, as your mother has already remarked, the ground is covered with snow, and affords no vegetation but a little moss, which is found on the bodies of trees; consequently the larger animals, such as cattle, &c. cannot subsist there. The reindeer is peculiar to those parts, and supplies his master with a scanty provision during that dreary season; but as they are valuable for many other purposes, they are unwilling to kill them, but from necessity; the flesh, of the whale is therefore reckoned a dainty, which may afford us a lesson, to be contented with beef and mutton, and to discourage that spirit of gluttony and sensual indulgence, that prevails too glaringly at the tables of the rich, who are seldom satisfied with one or two plain dishes, but cover their tables with a profusion, that invites a false appetite, and wastes the good things that are provided for our use.

*CHARLES.* Do whales ever stray so far from their usual haunts, as to be found on our coasts? It would give me great pleasure to see one.



*Mr. HARCOURT.* There have been instances of a few, that have been left at low water on shore, but they occur but seldom; when it happens, they are called royal fish, and become the property of the king and queen. Notwithstanding its vast size, the whale swims swiftly, and generally against the wind. The female brings but one, or at most two young ones at a time, which are nine or ten feet long; they suckle their young, and if pursued, shew the same maternal solicitude for the preservation of their offspring, as land animals, by wrapping them up in their fins close to their bodies.

*SOPHIA.* Pray, does the whale yield any other produce, that is useful to man, except oil and whale-bone?

*Mr. HARCOURT.* Yes; Spermaceti is prepared from the oil that is found in the head of a whale. It is melted over a gentle fire, and put into moulds, like those wherein sugar loaves are formed; when cold and drained, it is taken out, and melted over again, till it be well purified and whitened; it is then cut with a knife into flakes, and is used as a medicine for various complaints of the lungs; it is also used for making candles, which are but little inferior to those made of wax.

*CHARLES.* I cannot imagine what means can be devised to catch and manage an animal of such prodigious size.

*Mr. HARCOURT.* No animal is so large or powerful, but must yield to the superior sagacity of man. The method of taking whales is truly curious, and I shall have pleasure in entertaining you with a recital of it.

*ALL.* Pray begin, we are all attention.

*Mr. HARCOURT.* The fleet usually sets sail about the beginning of April, and steers northward, till they reach about the 75th degree of north latitude, where they usually begin to meet with the ice. It is among these huge heaps of ice, that float about in these seas, that they find the whale, and there most of the vessels take their station for the fishing. In the

English whale fishery, every ship has six or seven boats belonging to it, each of which has one harpooner, one man to steer, one to manage the line, and four seamen to row it; each boat is provided with two or three harpoons, several lances, and six lines fastened together, each one hundred and twenty fathoms long. To each harping iron is fastened a strong stick, about six feet long, and a soft pliable line of as many fathoms, called the fore gauger, which is fastened to the lines in the boat. The instrument with which the whale is struck, is a harping iron, or javelin, pointed with steel, in a triangular shape, like the barb of an arrow. The harpooner, upon sight of the fish, flings the harping iron with all his might against its back; and if he be so fortunate as to penetrate the skin and fat, into the flesh, he lets go a line fastened to the harping iron, at the end of which is a gourd, which swimming on the water, discovers where the whale is: for, the minute he is wounded, he plunges to the bottom, commonly swimming against the wind; and this is the moment of danger, lest he should outrun the length of the line, and pull the boat after him into the deep; to guard against this inconvenience, a man is fixed by the line with a sharp knife, ready to cut it in a moment, in case of necessity. If the whale return for air to breathe, the harpooner takes the opportunity to give him a fresh wound, till fainting by loss of blood, from repeated wounds, the men seize that moment for approaching him, and thrusting a long steel lance under his gills, into his breast, and through the intestines, soon dispatch him. When the carcase begins to float, they cut holes in the fins and tail, and tying a rope in them, tow him to the vessel, where he is fastened to the larboard side of the ship, floating upon his back, almost level with the sea.

*CHARLES.* What wonderful skill and dexterity are requisite in a Greenland sailor! I should like to make one voyage with them.

*Mrs. HARCOURT.* Your curiosity and ardour are

excited by the account your father has given us of their expeditions, but you are not aware of the hardships they undergo from the severity of these northern climates.

*AUGUSTA.* I have been accustomed to look with contempt on such people, as greatly my inferiors; but, for the future, I will try to respect every body whose employments are useful.

*Mr. HARCOURT.* You will do right; for a Greenland whale catcher is a much more valuable member of society, than an idle man of fortune, who lives on the labours of others. In order to take the blubber or fat, from which they procure the oil, and the fins, as they are called, or whalebone, several men get upon the fish, equipped with a kind of iron caulkers or spurs, to prevent their slipping, and cut off the tail, which is hoisted on deck, and then cut square pieces of blubber, weighing two or three thousand pounds, which are hoisted on board with the capstan, where each piece is again divided into smaller pieces, of two or three hundred pounds weight, then these are thrown into the hold, and left for a few days to drain. When all the blubber is cut from off the belly of the fish, it is turned on one side, by means of a piece of blubber, left in the middle, called the cant or turning piece: thus they cut out the sides in large pieces, which they call hockies. The next operation is to cut out the two large jaw bones, situated in the under lip, which when hoisted on deck, are cleaned, and fastened to the shrouds, with tubs placed under them to catch the oil which they discharge. The carcase is left to float, and supplies food for Greenland birds, called malle-muck, &c. After the pieces of blubber have lain a few days in the hold, they hoist them on deck, cut them into small pieces, and put them through the bung holes into their casks; one of the largest fish will fill more than seventy butts. The produce of a good large whale is valued at about one thousand pounds. When thus richly laden, they begin to sail homewards with their spoil:

on their return, the fat is to be boiled, and melted down into train-oil. The whale fishery begins in May, and continues through the months of June and July. Whether the ships are successful or not, they must come away, and get clear of the ice before the end of August.

*SOPHIA.* I thank you, my dear papa, for this very entertaining account. I shall never see a piece of whalebone, but I shall think of the labours and difficulties of the poor Greenland sailors.

*CHARLES.* I admire the courage and ingenuity of those who first attempted to catch whales.

*MR. HARCOURT.* Probably accident discovered the use that might be made of them, and induced some needy bold adventurer to make the attempt; but many must have been the hazards and disappointments, before the art was reduced to a system, as it is now. Rude and imperfect is the beginning of all knowledge. Perseverance and experience have contributed more than genius, to the discovery of things useful, to accommodate the life of man.

*MRS. HARCOURT.* Much is due to the man who first ventured his life to procure so useful a commodity as train-oil, without which many must pass a long dreary winter's night, without even the cheering rays of a lamp.

*HENRY.* But, mamma, they can buy candles.

*MRS. HARCOURT.* Candles, indeed, are very useful; but oil is cheaper, and there would not be a sufficient quantity of tallow to light our streets of a night. All the cities in Europe are lighted with oil, which is a great accommodation to their respective inhabitants.

*CECILIA.* Are there no other fisheries you can give us an account of, papa?

*MR. HARCOURT.* Yes, my dear, the cod, herring, and salmon fisheries are very useful and extensive, and employ a great number of hands; but our conversation has held long enough for one time, we will reserve them for the subject of another evening.

*MRS. HARCOURT.* It is almost supper time, and little Henry seems ready for bed.

*HENRY.* Indeed, mamma, I am not very sleepy, and could sit a great while longer to hear papa tell us more about these huge whales, and mountains of ice.

*Mr. HARCOURT.* I will oblige you another time. It is too late now. Adieu, my dear children.

CONVERSATION III.

Mr. and Mrs. HARCOURT, AUGUSTA, SOPHIA, CECILIA, CHARLES, and HENRY.

*CECILIA.* **W**E have all waited with the greatest impatience for the hour of meeting. If the cod and herring fisheries afford us as much entertainment as the catching of whales, we shall not soon be tired.

*Mrs. HARCOURT.* I am glad to hear you were pleased with last night's conversation; it is a proof that your minds are capable of relishing rational amusement. An early habit of trifling is difficult to be subdued, and should be carefully avoided; thousands are rendered unhappy by it; for having never been accustomed to exercise their faculties, as they grow up, they find every thing fatiguing that requires reflection, and as the mind cannot rest wholly inactive, they fly from one trifling, useless pursuit, to another; always tired of themselves, and rendering no benefit to others; but a well-regulated mind is marked by the judicious disposal of time, converting even amusement into instruction. Nature and art present so many objects, calculated to amuse and interest, that none but the idle need want a succession of employment.

*AUGUSTA.* Pray, have the kindness to instruct me how to fill up my time. I am often so much at a loss what to do with myself, that I wish for night, to put an end to the long day. As soon as my lessons are over, and nothing can be more tiresome than they are, I am without employment, and wander about

without knowing what to do with myself. My governess says, that I must not be troublesome to her, after I have finished my tasks; so I have no body to converse with, nor any thing to amuse me, but playing about, till I am tired.

*Mrs. HARCOURT.* Come to us every evening; I hope our conversations will furnish you with many sources of entertainment for your leisure hours. I am willing to point out whatever may occur worthy your further attention, and by strictly adhering to a few simple rules, you will find the day become as short as you wish it.

*AUGUSTA.* Pray give me these rules. I shall willingly adopt them.

*Mrs. HARCOURT.* Perhaps it will not be so easy, at first, as you imagine; ill habits are difficult to surmount; but by degrees it will become familiar, and in time agreeable. In the first place, never be unemployed; read, draw, work, walk, and accustom yourself to observe every thing you see with attention; consider how they are made, what the materials are, and from whence they come. If you are unable to discover the answers, keep a little book, and make a memorandum of what you want to know, and we will endeavour to give you information. This alone will fill many an hour, that now passes tediously away.

*AUGUSTA.* I thank you for these directions, and will begin to-morrow; but I have hindered Mr. Harcourt from beginning his account of the cod.

*Mr. HARCOURT.* The cod is a fish of passage, and is found from eighteen inches to three or four feet long, with a great head, and teeth in the bottom of the throat, its flesh white, its skin brownish on the back, and covered with a few transparent scales. It eats excellent, when fresh; and if well prepared and salted, will keep a long time. Salt-fish or stock-fish, commonly eaten in lent, is cod thus prepared. There are two kinds of salt cod, the one called green or white, the other dried or cured. The most essential thing in the green cod-fishery, is the skill of the per-

sons employed to open the fish, to cut off the heads, and to salt them, upon which last the success of the voyage chiefly depends. The principal fishery for cod is on the banks of Newfoundland, in North-America; and the best season, from the beginning of February to the end of April, when the cod, which during the winter, had retired to the deepest part of the sea, return to the bank, and grow very fat. Each fisher takes but one cod at a time, yet the more experienced will catch from three hundred and fifty, to four hundred every day. This is a very fatiguing employment, both on account of the weight of the fish, and the extreme cold which reigns on the bank. They salt the cod on board. The head being cut off, the belly opened, and the guts taken out, the salter ranges them in the bottom of the vessel, head to tail, and having thus made a layer of them, a fathom or two square, he covers them with salt, over this he places another layer of fish, which he covers as before; and thus he disposes all the fish of that day, taking care never to mix the fish of different days together. By the time they have lain three or four days thus to drain, they are removed into another part of the vessel, and salted again; then they are left untouched till the ship has got its load, unless they put them in barrels for the conveniency of room.

*SOPHIA.* The curing and taking of cod must be less disagreeable and dangerous than whale-catching. I had no idea that the catching of fish alone employed so many men.

*Mrs. HARCOURT.* We are apt to use and consume the necessaries and conveniences of life, without reflecting on the pains and labour necessary to obtain them. The smallest domestic accommodation is frequently not to be had, without the assistance of several hands; a pin or needle, for instance, employs a great number of workmen, before they are brought to the degree of perfection in which we receive them. And the supply of a common table, if we consider the resources from which it is drawn, most probably em-

employs the time and labour of thousands ; but we interrupt your father from proceeding, this subject may be resumed another time.

*Mr. HARCOURT.* In the fishing for dry cod, vessels of various sizes are used, though such are generally chosen as have large holds, because this kind of fish encumbers more than it burthens. As cod can only be dried by the sun, the European vessels are obliged to put out in March or April, in order to have the benefit of the summer for drying. Indeed the English send vessels for cod later, but they only purchase of the inhabitants what had been caught and prepared before hand. In exchange for which, we carry them meal, brandies, biscuits, pulse, molasses, linen, &c. The fish chosen for this purpose, though the same species as the green cod, is yet much smaller. As soon as the captains arrive, they unrig all the vessels, leaving nothing but the shrouds to sustain the masts ; and, in the mean while, the mates provide a tent on shore, covered with branches of fir, and sails over them, with a scaffold, fifty or sixty feet long, and about one third as broad. While the scaffold is making ready, the crew are fishing, and as fast as they catch, they bring their fish, open them, and salt them on moveable benches ; but the main salting is performed on the scaffold, called flake. When the fish have taken salt, they wash them, and lay them on piles, on the galleries of the scaffold, to drain again ; when sufficiently drained, they are ranged on hurdles, a fish thick, head against tail, with the back uppermost ; observing, while they lie thus, to turn and shift them four times every twenty-four hours. When they begin to dry, they lay them in heaps of ten or twelve a piece, to retain their warmth, and continue to enlarge the heap every day, till it becomes double its first bulk. At length they join two of these heaps into one, which they turn every day as before ; lastly, salt them over again, beginning with those that had been salted first, and in this state lay them in huge piles, as big as hay.



ricks ; and thus they remain till they are carried on ship board, where they are laid on branches of trees, disposed for that purpose, in the bottom of the vessel, with mats around them, to prevent their contracting any moisture. There are four kinds of commodities drawn from cod ; the sounds, which is a jelly like substance, that covers the inside of the main bone, and the tongues are salted at the same time with the fish, and barrelled up for eating. The roes or eggs being salted and barrelled, are useful to cast into the sea, to draw fish together, particularly pilchards ; and lastly the oil, which is used in dressing of leather ; and thus, by the art and ingenuity of man, every part of this fish, that can be serviceable is put to use ; and by his skill in curing and drying it, a large supply of wholesome provision is preserved, which must otherwise be lost. Nor is this care bestowed on the cod alone ; the herring supplies food to vast numbers of families, especially the poorer sort, to whom they are a great relief, when other provisions are dear ; but perhaps you are all tired of this subject, and wish to hear no more concerning the catching of fish ; if that be not the case, the herring, though a small fish, will furnish us with wonders almost as extraordinary as the whale.

*HENRY* I am the youngest of the company, and I am not at all tired.

*CHARLES.* You surprise me by talking of wonders concerning the herring ; I have seen many of them, but never observed any thing in them to excite my attention, beyond fish in common.

*Mr. HARCOURT.* It is not any thing remarkable in the construction of the individual fish, to which I allude, but to the prodigious numbers in which they assemble, at certain seasons of the year. About the beginning of June, a shoal of herrings, in bulk not less than the whole extent of Great-Britain and Ireland, comes from the north, on the surface of the sea ; their approach is known to the inhabitants of Shetland (an island to the north of Scotland) by sev-

eral tokens in the air and water, as by the birds, such as gannets, &c. which follow, in order to prey upon them; and by the smoothness of the water. It is not certainly known whence they come, though it is probable, that their winter rendezvous is within the arctic circle, where the seas swarm with insect food in greater abundance than in our warmer latitudes. They cast their spawn, when they arrive in these seas, for they come to us full, and are shotten long before they leave us. The great shoal divides into columns of five or six miles in length, and three or four in breadth, reflecting, in bright weather, as they pass, many splendid colours.

*SOPHIA.* Well might you say, you had wonderful things to relate; I had formed no idea of shoals of fish of such prodigious extent. The astonishing particulars we have already heard, make me suppose that the sea, and its produce, would furnish us with an inexhaustible fund of entertainment.

*MR. HARCOURT.* The subject is too extensive for our limits; the wonders of the deep have not yet been fully explored; but the most obvious particulars, that are ascertained, I shall with pleasure relate, as they illustrate and confirm our notions of the wisdom and goodness of that divine Being, who careth for all the works of his creation, and has provided for the respective wants of each.

*CECILIA.* Pray, papa, what kind of fish is the herring? I am not at all acquainted with it.

*MR. HARCOURT.* The herring is a small salt-water fish, with a bluish back, and a white silvered belly. It is commonly said that nobody ever saw a herring alive, they die so immediately on being taken out of the water; but there have been instances to the contrary. By what I have already told you, you will perceive that the herring is a fish of passage; they go chiefly in shoals; and are fond of following any fire or light; indeed, as they pass, they resemble a kind of lightning themselves, their colours glancing against the sun. The method of pickling and curing herrings

is simple ; there are two ways of doing it, the one makes white or pickled herring, the other what is called red herring. The white or pickled herring is prepared by cutting open and gutting the fish, as soon as it is taken out of the water, but the milts and roes are always left in ; they are then washed in fresh water, and left for twelve or fifteen hours in a tub full of strong brine, made of fresh water and sea salt. They are then taken out and drained, and when well drained, put up in barrels, disposed evenly in rows or layers, pressed well down, and a layer of salt strewed over them at top and bottom. After washing, gutting, and salting the fish, as above, when they intend to make them red herrings, they string them by the head on little wooden spits, and hang them in a kind of chimney, made for the purpose, and when the chimney is filled, which generally requires ten or twelve thousand fish, they make a fire underneath of brush-wood, which yields much smoke, but no flame, which mostly dries them sufficiently in twenty-four hours ; they are then barrelled for keeping. These are the most important fisheries, and employ by far the greatest number of people ; though there are many poor men who live on the sea coasts, whose scanty subsistence depends on the dangerous and precarious employment of fishing ; a little boat is their chief treasure, in which they venture out in rough and boisterous weather, when the pressing wants of their family urge them to the undertaking.

*Mrs. HARCOURT.* Their danger and hardships are increased, by being obliged to struggle with rough weather, and the storms of winter, that being the principal season for fishing.

*CECILIA.* The sufferings of the poor are very great on shore, in cold weather ; their miserable huts and tattered cloaths, scarcely defending them from the sharpness of the air, not to mention their scarcity of fuel. I wonder how they support such hardships.

*Mrs. HARCOURT.* Aged persons and infants sometimes sink under these difficulties, but those in mid-

dle life, who are able to use exercise, support them with less injury. Let these reflections instruct us to feel for the wants of others, and endeavour to relieve them, by retrenching our superfluous indulgencies ; they should inspire us at the same time with gratitude to the Giver of all Good, for the numerous blessings he has allotted us, above many other of our fellow creatures : with thankful acknowledgment, let us close the day, and each one retire to repose.

#### CONVERSATION IV.

*CHARLES.* I HAVE found the subject of the fisheries so new and entertaining, that far from being tired of them, my curiosity is raised to hear more of them. When you returned from Ireland, I think you mentioned having visited the salmon fisheries ; be so kind as to give us the particulars you remember of them.

*Mr. HARCOURT.* The salmon is a very curious fish, its instincts and habits are well worth our attention. The principal salmon leaps (as they are called) in Ireland, are at Coleraine, and at Ballyshannon, which is a small town situated near the sea, with a bridge of fourteen arches over a river, which at a small distance, falls down a ridge of rocks about twelve feet, and at low water forms a very picturesque cascade.

*HENRY.* Do the salmon abound in that river ? It must be very pretty to see them tumble down the waterfall.

*Mr. HARCOURT.* Almost all the rivers, lakes, and brooks in this island afford great plenty of these fish ; some during the whole year, and some only during certain seasons ; they generally go down to the sea about August and September, and come up again in the spring months ; and, what is very remarkable, the same fish always come back to the same river, so that the owners of the fishery are not afraid of losing their fish.

*SOPHIA.* Fish appear so stupid, and void of intelligence, that extraordinary instincts in them strike one with more wonder than in other animals.

*Mr. HARCOURT.* The great Creator has impressed certain propensities so strongly on different animals, that they are irresistible; and this powerful inclination stands them in stead of reason, which is given to man, as a being of a superior order, to guide his judgment and direct his conduct through the various scenes of life.

*CHARLES.* What inducement can these fish have for thus changing the place of their habitation?

*Mr. HARCOURT.* Fresh water seems to be more suitable, than the sea, for depositing their eggs and rearing their young. It is said that the females work beds in the sandy shallows of rivers, and there lay their eggs, which the male impregnates; afterwards they both are employed in covering the eggs with sand, each partaking in the labour necessary for bringing the eggs to perfection; these in time become vivified, and take their course to the sea, being then about four inches long. After a stay of six weeks, or two months, they return up the same rivers; the salt water having caused them to attain nearly to half their full growth, in that short space of time.

*Mrs. HARCOURT.* Salmon, and perhaps many other kinds of fish, seem absolved, by the laws of nature, from the sedulous attention in rearing their young, that is requisite in birds and terrestrial animals; their chief care is to provide for the preservation of the eggs, by depositing them in a suitable place, and after they have performed that office, they appear to have no further thought about them. Strangers to the pleasing solicitude of parental fondness, they may with propriety be ranked in an inferior scale of existence to the beautiful feathered race, whose tenderness and patient care may serve as models to careless mothers, who neglect their offspring, from indolence, or a love of other pursuits.

*Mr. HARCOURT.* When I was at Ballyshannon, I passed several hours in watching the fish leap up the cascade, and it is hardly credible, but to those who have been eye-witnesses, that they should be able to dart themselves near fourteen feet perpendicularly out of the water ; and, allowing for the curvature, they leap at least twenty. They do not always succeed at the first leap ; sometimes they bound almost to the summit, but the falling water dashes them down again ; at other times they dart head foremost, or side-long upon a rock, remain stunned for a few moments, and then struggle into the water again ; when they are so successful as to reach the top, they swim out of sight in a moment. They do not bound from the surface of the water, and it cannot be known from what depth they take their leap ; it is probably performed by a forcible spring with their tails bent ; for the chief strength of most fish lies in the tail. They have often been shot, or caught with strong barbed hooks fixed to a pole, during their flight, as it may be termed ; and instances have been known of women catching them in their aprons. At high water, the fall is hardly three feet, and then the fish swim up that easy acclivity without leaping. Sometimes I have seen at low water fifty or sixty of these leaps in an hour, and at other times only two or three. I placed myself on a rock on the brink of the cascade, so that I had the pleasure of seeing the surprising efforts of these beautiful fish close to me ; and at the bottom of the fall, porpoises and seals tumbling and playing among the waves ; and sometimes a seal carries off a salmon under his fins.

*AUGUSTA.* I knew a boy of nine years old, who lived in Scotland, where the rivers are remarkably clear ; he saw a salmon sporting in the water at the bottom of his father's garden, and jumped in. The fish was large and strong, and struggled to escape from his hold ; but after a pretty smart contest, the boy came off victorious, and brought his antagonist safe to land.

*HENRY.* That must have been fine sport; I should like to have been of the party.

*CHARLES.* This account is very entertaining; but I want to know their method of taking these fish.

*Mr. HARCOURT.* They are caught in wiers, which are formed by damming up the river, except a space of three or four feet in the middle, which the salmon having passed, are caught in a small inclosure, formed by stakes of wood; the entrance is wide, and gradually lessens, so as barely to admit a single salmon at a time. Every morning, during the fishery, they are taken out, by means of a staff, with a strong barbed iron hook, which is struck into them. But at Ballyshannon, by far the greater number is caught in nets below the fall; they sometimes catch near one hundred at a throw. The time of the fishery is limited; and after it is elapsed, the inclosure is removed, the nets are laid aside, and the fish are at liberty to stock the rivers with spawn. The chief salmon fisheries, besides those in Ireland, are at Berwick on the Tweed, and along the coasts of Scotland. Vast quantities are salted or pickled, and put up in kegs, and sent to different parts of the kingdom.

*Mrs. HARCOURT.* There are also great quantities of salmon brought fresh to the London markets, by being packed in ice; which, by excluding the air, is found a preservative to many other things. The inhabitants of the northern parts of Europe, the Russians especially, preserve their fowls and other provisions, during their hard winters, when meat is difficult to be procured, in snow and ice.

*Mr. HARCOURT.* It would be tedious and unnecessary to particularise the various kinds of fisheries that are in different parts of the world. Oysters, lobsters, pilchards, anchovies, and sturgeon, are all caught in great quantities; the three latter pickled or salted down for use. *Cavear*, or *kavia*, a sauce much prized by the Italians, is made of the roe or eggs of the sturgeon. All these form extensive branches of commerce, and supply vast numbers of peo-

ple with food, who reside at a great distance from the places at which they are caught; at the same time, that they are a means of maintaining thousands of families, by furnishing useful and profitable occupation to them; nor must we omit to mention the great variety and vast numbers of fish, that are eaten without being salted, which daily supply our markets, and provide us with an agreeable change of diet. The produce of the ocean is inexhaustible; nor is it confined to fish alone; the bottom is covered with vegetation in many parts.

*AUGUSTA.* How is it possible to know that?

*Mr. HARCOURT.* The sea throws up a great variety of sea weeds. Divers also relate that this is the case.

*CHARLES.* Can men dive to the bottom of the sea?

*Mr. HARCOURT.* There are people who are very expert in diving; but a full account of this curious art is better deferred to another evening, as we have not time to enter into a complete description of the methods of performing it.

*SOPHIA.* I have heard that the Giant's Causeway in Ireland is a great natural curiosity; had you an opportunity of seeing it, when you were in that country?

*Mr. HARCOURT.* It was an object to which I paid particular attention. It is situated at the northern extremity of the island. It consists of about thirty thousand natural pillars, mostly in a perpendicular situation. At low water the causeway is about six hundred feet long, and probably runs far into the sea, as something similar is observed on the opposite coast of Scotland. It is not known whether the pillars are continued under ground, like a quarry. They are of different dimensions, being from fifteen to twenty-six inches in diameter, and from fifteen to thirty-six feet in height: their figure is generally pentagonal or hexagonal. Several have been found with seven, and a few with three, four, and eight sides, of irregular sizes; every pillar consists



as it were of joints or pieces, which are not united by flat surfaces; for on being forced off, one of them is concave in the middle, and the other convex, many of these joints lie loose upon the strand. The stone is a kind of besaltes, of a close grit, and of a dusky hue; it is very heavy, each joint generally weighing two hundred and a half. It clinks like iron, melts in a forge, breaks sharp, and by reason of its extreme hardness, blunts the edges of tools, and by that means is rendered incapable of being used in building. The pillars stand very close to each other, and though the number of their sides differ, yet their contextures are so nicely adapted, as to leave no vacuity between them, and every pillar retains its own thickness, angles, and sides, from top to bottom. These kinds of columns are continued, with interruptions, for near two miles along the shore. By its magnitude and unusual appearance, it forms altogether an object of great rarity, and is mostly visited by all strangers, who have any curiosity.

*Mrs. HARCOURT.* This is a wonderful account. It seems to be one of those productions of nature that may be termed an unique. I know of nothing similar to it. I met with a passage, last night, in Colinson's History of Somerset, though not immediately referring to the subject before us, that I cannot resist the pleasure of repeating. It is concerning a peculiar property of the limpet (a species of shell-fish,) that is found at Minehead in that county; that contains a liquor curious for marking linen. When the shell is picked off, there will appear a white vein lying transversely in a little furrow next the head of the fish, which may be taken out by a bodkin, or any other pointed instrument. The letters or figures made with this liquor will presently appear of a light green colour, and if placed in the sun, will change into the following colours; if in winter, about noon; if in summer, an hour or two after sun-rising; and so much before setting; for in the heat of the day in summer, it will come on so fast, that the succession of

each colour will scarcely be distinguished. Next to the first light green, it will appear of a deep green, and in a few minutes change to a full sea green; after which, in a few minutes more, it will alter to a blue, then to a purplish red: after which, lying an hour or two, (if the sun shines) it will be of a deep purple red, beyond which the sun does no more. But this last beautiful colour, after washing in scalding water and soap, will, on being laid out to dry, be a fair bright crimson, which will abide all future washing. This species of limpets are, some red, others white, black, yellow, brown, and sand colour, and some are striped with white and brown parallel lines.

*SOPHIA.* I should like to have a specimen of this marking liquor. It must be the most elegant of all methods of imprinting letters, &c. on linen.

*Mrs. HARCOURT.* I believe I have trespassed upon your father's time by this account, but I was much pleased with it. Cecilia, close this conversation, by reciting Mr. Keate's Address to the Ocean.

#### ADDRESS TO THE OCEAN.

*CECILIA.* "Hail! thou inexhaustible source of wonder and contemplation? Hail! thou multitudinous ocean! whose waves chase one another down like the generations of men, and after a momentary space, are intermerged for ever in oblivion! Thy fluctuating waters wash the varied shores of the world, and while they disjoin nations, whom a nearer connection would involve in eternal war, they circulate their arts, and their labours, and give health and plenty to mankind. How glorious! how awful are the scenes thou displayest! whether we view thee when every wind is hushed; when the morning sun silvers the level line of the horizon; or when the evening track is marked with flaming gold, and thy unrippled bosom reflects the radiance of the over-arching heavens! Or whether we behold thee in

thy terrors! when the black tempest sweeps thy swelling billows, and the boiling surge mixes with the clouds! when death rides the storm, and humanity drops a fruitless tear for the toiling mariner, whose heart is sinking with dismay! And yet, mighty Deep! 'tis thy surface alone we view. Who can penetrate the secrets of thy wide domain! What eye can visit thy immense rocks and caverns, that teem with life and vegetation? or search out the myriads of objects, whose beauties lie scattered over thy dread abyss? The mind staggers with the immensity of her own conceptions; and when she contemplates the flux and reflux of thy tides, which, from the beginning of the world, were never known to err, how does she shrink at the idea of that Divine Power, which originally laid thy foundations so sure, and whose omnipotent voice hath fixed the limits, where thy proud waves shall be stayed!"

CONVERSATION V.

*HENRY.* I HAVE been thinking, dear papa, that if there were as many whales as herrings, the sea would be hardly large enough to hold them.

*Mr. HARCOURT.* Providence has wisely limited the fruitfulness of the larger animals, both on land and in the sea, to a small number: whales, lions, and eagles seldom bring forth more than two at a time. We may also observe with thankfulness, that the increase of noxious animals is generally restricted by the same wise law of nature; whilst those creatures, which are useful to man, multiply very fast. Did the birds and beasts of prey, and huge serpents, increase as fast as domestic animals, this globe would be no longer habitable; we should be forced to resign our places to them, and they would become lords of the creation.

*Mrs. HARCOURT.* Your observation ought to excite in us a lively gratitude for the wise arrangement

and proportion of creatures in the universe ; a striking proof of the wisdom and goodness that governs all things. I have been frequently astonished at the accounts I have read of the increase of fish. There have been found in one codfish, 3,686,760 eggs ; now, supposing only half, or even a quarter of these eggs to come to perfection, the increase is prodigious. Other kinds of fish multiply also in a surprising degree ; yet there is no reason to think that any one kind increases beyond its due proportion with the rest. According to what we remark among the animals, that we have an opportunity of observing, each has its enemy ; and it is reasonable to suppose that the same law prevails in the sea ; and that each kind has a powerful adversary that diminishes its numbers, and keeps them within due limits.

*SOPHIA.* Who could have the patience and perseverance to count such a vast number of small eggs ?

*Mrs. HARCOURT.* Many naturalists have taken great pains to investigate this curious subject ; but Mr. Harmer has pursued it with more success than any of them, by an ingenious method of first weighing the whole spawn very exactly, he then separated a certain number of grains, and carefully counted the number of eggs they contained, by which number he multiplied the remaining grains ; thus, by the advantage of method and regularity, he obtained the knowledge of a curious fact in nature, easily in comparison of the trouble he must have taken, to have ascertained it by the tedious method of counting the whole.

*CECILIA.* Now I am convinced of what you have often told me, that nothing can be well done without order and method. I will endeavour to be more attentive to this point, and do every thing with greater regularity for the future.

*Mrs. HARCOURT.* Order is, indeed, the best guide in every kind of business, and distinguishes a well taught mind, from one that is uninstructed. It should extend to all our concerns ; the disposal of

our time and money; the proportion of amusement and business should be regulated by some rule, and not left to the direction of mere chance, as is too often the case with many thoughtless people.

*CHARLES.* What a prodigious quantity of salt must be consumed in the curing of such multitudes of fish! I am ashamed to confess that I am ignorant whether salt be a natural or an artificial substance.

*Mr. HARCOURT.* I will give you some account of the manner of its production: you could hardly have chosen a more entertaining subject for our evening's conversation. Common salt, used for seasoning and preserving meat, fish, &c. is one of the most useful necessities of life; and is of three kinds, viz. fossile, or rock salt; sea, or marine salt; and spring salt. Fossile, or rock salt is found in large beds, or strata, within the bowels of the earth, sometimes crystallized, but more frequently in irregular masses of red, yellow, or blue colour.

*HENRY.* Coloured salt! I never have seen any of that kind, why do we not use it?

*Mr. HARCOURT.* All salt becomes white by grinding. There are mines of rock-salt in various parts of the world; they are found in Poland, Hungary, Germany, Italy, Spain, and England; as well as in some other countries in Europe. I shall confine myself to describe the manner of procuring this kind of salt, before I say any thing of the other sorts. The account of the Polish mines, in the village of Wiliska, five leagues from Cracow, the capital of Poland, which were discovered in the year 1251, will furnish us with an idea of them, that will serve for a description of salt mines in general. Their depth and capacity are surprising. Within them exists a kind of subterraneous republic, or commonwealth, which has its policy, laws, families, &c. nay, even public roads, for horses and carriages, are kept here, for the purpose of drawing the salt to the mouth of the quarry, where it is taken up by engines. These horses, when they are once down, never see the light again; but the men take frequent occasions

of breathing the fresh air. What astonishment must a traveller feel, on arriving at the bottom of this wonderful abyss, where so many people are interred alive, and numbers of them even born there, that have never seen day light. The first thing that strikes him with surprise, is a long series of vaults, sustained by huge pilasters cut with the chissel out of the rock salt, resembling so many crystals, or precious stones of various colours, reflecting a lustre from the light of the flambeaux, which are continually burning, that dazzles the eye with its splendour; nor can he be less surpris'd at observing a clear rivulet of fresh water running through the midst of these mountains of salt, and supplying the inhabitants with a source of comfort and accommodation, little to be expected in such a dreary region. The workmen he will find employed in hewing the rocks of salt, in form of huge cylinders, using hammers, pick-axes, and chissels, much as in our stone quarries, in order to separate the several banks. As soon as the massive pieces are got out of the quarry, they break them into fragments proper to be thrown into the mill, where they are ground, and reduced into a coarse farina, or flour, which serves all the purposes of sea-salt.

*CHARLES.* I remember going once with you into a stone quarry, and can therefore easily form an idea of it; but I am surpris'd to hear that salt is so hard as to require hammers and pick-axes to separate it.

*MR. HARCOURT.* In its natural state, the masses of rock salt are very hard; there are two kinds of sal gemma found in the salt mines of Wiliska; the one harder, and more transparent, and the crystallization of which appears more perfect than that of the other; this is the sal gemma of the druggists and dyers. It cuts like crystal, and is frequently used for toys, chaplets, little vases, &c. I think I must procure you some specimens of them, Sophia; they will deserve a place in your cabinet of natural rarities.

*SOPHIA.* I shall value them very highly, both as your gift, and as a great curiosity.

*Mr. HARCOURT.* The other kind is less compact, and suitable only for kitchen uses. The colour of the salt, while in the mass, is a little brownish; and yet, when ground, it becomes as white as if it had been refined. Some of these masses are found as hard and transparent as crystal; some white, yellow, blue, and fit for various works of taste, in which they engrave as on precious stones. The mine is cold and moist, which causes some difficulty in reducing the salt into powder. They make a blackish salt of the water drawn out of it, which serves to fatten cattle. The salt mines of Catalonia are found in the mountains of the Duchy of Cordona; they form a solid mountain of rock salt, between four and five hundred feet in height, and a league in circumference, and descending to an unknown depth below the surface. This prodigious mountain of salt, which has no mixture of other matter with it, is esteemed a great natural curiosity, and has raised a doubt among naturalists, whether salt does not vegetate or grow. To give you an imperfect idea of the quantities of salt produced annually, it is said, that one of the Norwich pits, which is in Cheshire, has yielded, at a medium, four thousand tons of salt in a year. This salt is esteemed unfit for domestic uses, in its natural state; and therefore they use the method practised in Poland, Hungary, and many other places, on the coarser rock salt; they refine it, by dissolving it in weak brine, and then boiling it into salt again. The works, where the rock salt is refined, are called Refineries. The rock salt is broken small, and put into leaded cisterns, where it is dissolved in cold sea-water, when the solution has stood a day and night to settle, it is drawn off from the sediment into the salt-pan, and refined into salt in the same manner that common salt is boiled up. The scratch or calcarious matter falling from it, forms a crust on the sides of the cistern. They are careful not to waste the brine left in the pans after the salt is taken out, but add it to the next quantity put into the pan, and so on to the end

of the works. I cannot dismiss the subject of rock salt, without mentioning the island of Toongming, in the East-Indies, which affords the most remarkable kind of fossile, or native dry salt, in the world. The country is, in general, very fruitful, but in certain parts of the island there are spots of ground, of several acres, which appear wholly barren, yielding not the least appearance of any thing vegetable on them. These spots of ground taste very salt, and abound with salt in such a manner, as not only to supply the whole island, but a great part of the neighbouring continent.

*AUGUSTA.* Have the people in this country no other mark to find out the places that produce the salt, than the barrenness of the spot?

*Mr. HARCOURT.* When the inhabitants perceive the ground become dry, and covered with white spangles, which are pieces of salt, they are sufficiently assured that this is a proper place to dig for that commodity. It is very remarkable that the same pieces of land, which produce vegetables one year, will produce this salt another; and on the contrary, the salt parts will, some seasons, be covered with vegetation. The salt work in this island is of great advantage to the inhabitants, and supplies all the poor, during the season, with employment. The men are occupied in collecting the salt and wetting the earth, and the women in boiling up the water, which they attend as carefully as the men. The second kind of salt is marine or sea salt, which is made from sea water, thickened by repeated evaporation, and at length crystallized.

*HENRY.* I do not understand what evaporation means.

*Mr. HARCOURT.* Heat caused either by the action of the sun or fire, makes the watery particles of sea-water fly off, or disperse into the air, and leave the saline parts at the bottom of the vessel, which is called evaporation. The salt, thus deprived of the water, crystallizes, or hardens, and shoots into crystals,



such as I shewed you the other day in the microscope. Opaque stones, pyrites, and minerals, when regularly formed, are said to be crystallized; as well as transparent stones and salts. Ice will give you the idea of a complete crystallization, composed of long needle-like masses, flattened on one side, and joined together in such a manner, that the smaller are inserted into the sides of the greater. The crystals of different kinds of salts afford great variety and beauty of forms, and are curious objects of microscopic observation. The regularity of their figure, each different substance producing a form appropriate to itself, is a confirmation, that not only the more obvious works of nature, but also the internal structure of organized bodies, are formed with the same harmony, order, and beauty, that characterize the other parts of the creation. Marine salt is prepared by boiling sea-water. The salt-works are erected near the sea, in order to afford an opportunity of conveying the salt-water into them by pipes, which is afterwards boiled in pans of an immense size. It is necessary to have the roofs of wood fastened with wooden pegs, as the effluvia, which evaporates from the boiling pans, rusts, and destroys iron in a very little time. Whilst boiling, they purify it with whites of eggs, or sometimes the blood of sheep or oxen is used for the same purpose. The saline liquor which remains from the making of salt, is called bittern, and is used for medicinal purposes.

*Mrs. HARCOURT.* I think we may observe in the process of salt, as well as many other things, that nature provides materials for man's ingenuity and industry to work upon; nay, she supplies us with few things, that does not require some labour to render them suitable for our use.

*Mr. HARCOURT.* Nature has not only furnished us with materials to work with, but implanted in our minds such activity of disposition, and thirst of knowledge, as impels us to scrutinize the properties of these materials, and apply them to the purposes of

life. Much has already been discovered, more perhaps lies still behind ; the field is vast, and may supply useful and interesting occupation for many succeeding generations of men. The third, and last kind of salt, is prepared in much the same manner as marine salt, from the water of salt-wells and springs, and is called brine, or fountain salt. The whitest, driest, and finest grained salt is sometimes made up in form of sugar loaves, in small wicker baskets. In preparing basket salt, they use resin, and other additions, to break the grain, and render it very small ; and, to finish the process, it is dried in stoves. Great quantities of brine or spring salt are made in most of the inland countries, as in Germany, Switzerland, Hungary, and in some parts of France and England. Lakes of this kind are found in the Podolian desert, near the river Borysthenes ; on the Russian frontiers, towards Crim Tartary ; in the kingdom of Algiers ; and in other countries. Where nature does not supply these lakes or ponds, artificial ones may be made. This is annually done very advantageously in France, where the chief coasts for bay-salt, are those of Bretagne, Saintonge, and the Pay d'Aunis. In order to make a saline, or salt-marsh, a low plot of ground must be chosen adjoining to the sea, and distant from the mouths of large rivers ; and to render it complete, it should be near some convenient harbour for vessels. The ground thus chosen, must be hollowed out to three ponds or receptacles. The first, into which the sea-water is admitted, may be called the reservoir ; the second receptacle, which is to be again divided into three distinct ponds, communicating with each other by narrow passages, and containing brine of different degrees of strength, may be called the brine-ponds ; and the third receptacle, is to be furnished with an entrance, between which and the brine-ponds, there is to run a long narrow winding channel, the rest of it is to be divided into small pits, containing a very strongly saturated brine, which is to be converted into salt, and they may therefore

properly be called the salt-pits. The first receptacle must communicate with the sea, by a ditch, defended by walls; the ditch should have a flood-gate to admit, retain, or let out the sea-water, as occasion may require. The bottoms of the reservoir, or brine-ponds, are to be lined with any kind of tough clay, or earth, that will hold water. The proper season for making salt in these artificial salinæ, is from May to the end of August. When the salt-men open the flood-gate, at the time the tide is out, to drain off all the stagnating water, and after repairing and cleansing the receptacles from mud and dirt, they admit the sea-water, at the next high tide, till it floats the whole marsh, and stands at a proper height in the reservoir. In a few days, most of the water, in the salt-pits, is exhaled by the power of the sun, and what remains is a very strong brine. They daily supply themselves with more salt-water, in proportion to what is exhaled by the sun, and the workmen draw out the crystals or salt, as they are formed every day, and dispose them in a pyramidical heap, which they cover over at the top with thatch or straw, to preserve it from the injuries of the weather. Thus, at a small expence and trouble, a salt is prepared, very fit for all domestic uses; and France, especially, is furnished with a very profitable article for exportation. The uses of common salt are various and extensive. Its acid and alkali are employed in many chemical operations in the arts. It is an important ingredient in the fusion of glass, which it whitens and purifies. It facilitates the fusion of the metallic parts of minerals; and its peculiar use in preserving meat, &c. and giving a poignancy to the taste of various kinds of food, is universally known. Common salt is also useful as a manure, by contributing to fertilize the soil.

*CHARLES.* You surprize me. I remember to have read in history, of princes, who commanded the lands of their enemies to be sowed with salt, that nothing might grow on them. The Bible furnishes me with an instance of it, when Abimelech destroy-

ed the city of Shechem, he ordered the place where it had stood, to be sowed with salt.

*Mr. HARCOURT.* It pleases me to observe, that you remember what you read, and that you apply it as occasion offers. Perhaps the error and prejudice of the ancients arose from this cause, that they were ignorant that though the salt is injurious, and destructive to all vegetables, yet it increases the fertility and productive qualities of the earth.

*Mrs. HARCOURT.* That is a very curious distinction, that I was unacquainted with before. It grows late; our lecture has been rather long this evening.

*Mr. HARCOURT.* It is time to separate, and as I have related the most important particulars concerning salt, and the manner of preparing it, we will withdraw. Good night, children.

## CONVERSATION VI.

*AUGUSTA.* **S**OME gentlemen dined with us to-day who came from Canada, in North-America. I believe they took me for an ignorant girl, that might easily be made to believe any thing. I assure you, they quite vexed me; they told me a number of improbable stories of an animal, that builds houses three stories high, makes bridges, and I know not what ridiculous stuff. I hate to be imposed upon, so I left the table as soon as the cloth was removed, and hastened here to tell you how I have been served.

*Mrs. HARCOURT.* Sophia, what is the name of this extraordinary animal, that has caused so much offence to Augusta?

*SOPHIA.* I suppose it was the beaver, mamma.

*AUGUSTA.* Ay, that is the very name; but I cannot believe these accounts to be true.

*Mrs. HARCOURT.* Sophia studies natural history, she shall give us the particulars with which she is acquainted, concerning this curious creature.

*Mr. HARCOURT.* Charles has been this morning to inspect a hat manufactory, and is therefore prepared to complete his sister's account of the beaver, by informing us what use is made of its fur. Sophia, it is your turn to begin.

*SOPHIA.* Beaver or Castor, makes a distinct genus of animals of the order of *Glires*, and class of *Mammalia*. The characters are, that the upper fore teeth are truncated, and hollowed obliquely, and that the lower are oblique at the apex; with a flat tail, and feet which have five toes on each, and palms adapted to swimming. Under this genus are comprehended three species. The Beaver or Fiber. Secondly, the Castor. Thirdly the Castor, called *Zibethicus*.

*Mr. HARCOURT.* Very well defined, with the method and precision of a naturalist. Give us now a description of the animal, and afterwards, its manner of living and habits.

*SOPHIA.* The Beaver is about four feet in length, and twelve or fifteen inches broad; his skin in the northern regions is generally black; but it brightens into a reddish hue, in the temperate climates. He is covered with two sorts of hair, one long, and the other a soft down; the latter, which is an inch in length, is extremely fine and compact, and furnishes the animal with a necessary degree of warmth, the long hair preserves the down from dirt and wet. The head is like that of the otter, but longer, the snout is pretty long, the eyes small, the ears short, round and hairy on the outside, but smooth within, and the teeth very long, the under teeth project the breadth of three fingers, and the upper, half a finger, all of which are broad, crooked, strong and sharp; besides those teeth, which are called incisors, which grow double, are set very deep in their jaws, and bend like the edge of an axe; they have sixteen grinders, eight on each side, four above, and four below, directly opposite to each other. With the former, they are able to cut down trees of a considerable size; with the latter, to break the hardest substances; the legs

are short, the fore-legs not exceeding four or five inches in length, the fore-paws are formed something like the human hand. These feet serve the beaver to dig, soften, and work the clay for different purposes, the hind feet are furnished with membranes, or large skins, extending between the toes, like those of ducks, and other water-fowl; the tail is long, a little flat, entirely covered with scales, supplied with muscles, and perpetually moistened with oil or fat, which the creature distributes all over them with his snout, and which he procures from four bags, which are placed under the intestines, and are found in every beaver, whether male or female. These bags are filled with a resinous liquid substance, which, when it is ejected, settles into a thick consistence. Physicians call it castoreum, and prescribe it as an excellent remedy against poisons, vapours, and other maladies, but when it grows old, it blackens, and degenerates into a dangerous poison.

*Mrs. HARCOURT.* Before Sophia relates the manners and occupations of this creature, let us give particular attention to the implements with which nature has furnished it. The form and strength of the teeth are suited to cutting of wood and hard substances, and we have already been told that with these they are able to fell trees; the fore-paws are adapted to handling and disposing the materials of the work; the hind-feet are formed for swimming, and evidently shew that the creature is intended to live in both elements, and is what is called an amphibious animal; the tail, from its flatness, and the hardness of its scales, may serve very well for a hod, such as bricklayers use for carrying mortar, &c. And now, Augusta, do you think it totally improbable, that a creature furnished with such tools, and endued with a proportionable degree of sagacity to use them, should be able to construct houses of three stories, or build bridges, &c.

*AUGUSTA.* Indeed I begin to be staggered; but is this really the case? Pray, Sophia, go on; for I am

impatient to hear what you have to tell us further on this subject.

*SOPHIA.* When they are going to chuse a place to build a habitation, they assemble in companies sometimes of two or three hundred, and after mature deliberation, fix on a spot where plenty of provisions, and all necessaries may be found. Their houses are always situated in the water; and when they can find neither lake nor pond adjacent, they endeavour to supply the defect, by stopping the current of some brook or small river, by means of a causey or dam; for this purpose they set about felling of trees, which several of them together effect pretty easily, with their strong teeth; they take care to chuse out those that grow above the place where they intend to build, that they may swim down the current. They also, with wonderful sagacity, contrive that they shall fall towards the water, that they may have the less way to carry them. After the tree is felled, they cut it into proper lengths, and then roll them into the water, and navigate them towards the place where they are to be used. The causey raised with these pieces of wood, is sometimes ten or a dozen feet in thickness at the foundation; it descends in a slope on the side next the water. The opposite side is raised perpendicularly like our walls, and the slope, which at its base, is twelve feet broad, diminishes towards the top to the breadth of two feet. They drive the extremities of these pieces of wood very near each other, into the earth, and interlace them with other stakes more slender and supple. But as the water, without some other prevention, would glide through the cavities, and leave the reservoir dry, they have recourse to a clay, which they perfectly well know how to procure, and which they work up into a kind of mortar with their tails, and close up the interstices with it, both within and without, and this entirely secures the water from passing away. If the violence of the water, on the footsteps of hunters, who pass over their work, damage it, they immedi-

ately set about repairing it. They build their cabins, either on piles in the middle of the small lakes, they have thus formed, on the bank of a river, or at the extremity of some point of land, that advances into a lake. The figure of them is round or oval, divided into three partitions, raised one above another. The first is sunk below the level of the dike, and is generally full of water, the other two stories are built above it. The whole edifice is mostly capable of containing eight or ten inhabitants. Each beaver has its peculiar cell assigned him, the floor of which he strews with leaves, or small branches of the pine tree, so as to render it clean and comfortable. Their works, especially in the cold regions, are completed in August or September; after which they furnish themselves with a store of provisions. During the summer, they regale upon all the fruits and plants the country produces. In the winter they eat the wood of the ash, the plane, and other trees, which they steep in water, in quantities proportionable to their consumption, and they are supplied with a double stomach, to facilitate the digestion of such solid food, at two operations. They cut twigs from three to six feet in length, the larger ones are conveyed by several beavers to the magazine, and the smaller by a single animal, but they take different ways. Each individual has his walk assigned him, to prevent the labourers from being interrupted in their respective occupations. These parcels of wood are not piled up in one continued heap, but laid across one another with interstices between them, that they may the easier draw out what quantity they want; and they always take the parcel at the bottom. They cut this wood into small pieces, and convey it to their cell, where the whole family come to receive their share. Sometimes they wander in the woods, and regale their young with a fresh collation. The hunters, who know that these creatures love green wood better than old, place a parcel of the former about their lodge, and then have several devices to ensnare



them. When the winter grows severe, they sometimes break the ice, and when the beavers come to the opening for air, they kill them with hatchets, or make a large aperture in the ice, and cover it with a very strong net, and then overturn the lodge, upon which the beavers, thinking to escape in their usual way, by flying to the water, and immersing at the hole in the ice, fall into the snare, and are taken.

*CECELIA.* Poor creatures! what can induce any body to be so cruel, as to ensnare and destroy such ingenious and industrious animals?

*Mr. HARCOURT.* Profit: the hunters in America catch vast numbers of them every year, for the sake of their skins, and bags of castor, which they bring to the merchants, who send them to Europe.

*CECILIA.* Pray what use do they make of their skins?

*Mr. HARCOURT.* I leave Charles to answer that question.

*CHARLES.* Men's hats are made of the fur of the Beaver. Women are employed by the hatters, to clear the skins of the hair; for which purpose they use two knives; a large one, like a shoe-maker's knife, for the long hair; and a smaller, not unlike a vine knife, to shave or scrape off the short hair or down. When the hair is off, they mix the stuff, putting to one third of dry castor, two thirds of old coat, a term they use for the hair of those skins which have been worn some time by the savages, and by that means is become finer than the rest. After it is mixed, they card it; which is pulling it smooth and even, between two things resembling a curry-comb, with fine teeth: such as are used to card wool with, before it is spun. They then take a proper quantity of this stuff for a hat, and put it upon the hurdle, which is a square table with chinks cut through it lengthwise, then the workman takes an instrument, called a bow, very like a fiddle-stick, and works the fur till it mixes well together, the dirt and filth passing through the chinks. In this manner they form

two gores or pieces of an oval form, ending in a sharp corner at top. These pieces, or capades, as they are called, being formed in this manner, they proceed to harden them into closer and more consistent flakes, by pressing them with a hardening skin or leather; they are then carried to the bafon, which is a sort of bench, with an iron plate fitted in it, and a little fire underneath it, upon which they lay one of the capades, sprinkled with water, and make use of a sort of mould to form it; when, by means of the heat of the fire, the water, and pressing, the substance thickens into a slight hairy sort of felt or stuff. After they have turned up the edges all round the mould, they lay it by, and proceed in the same manner with the other half. The next thing is to join the two pieces together, so as to meet in a point at the top, and form a high crowned cap. The hat thus bafoned, is removed to a large receiver or trough, which is a kind of copper kettle, of a peculiar shape, filled with hot water and grounds, after dipping the hat in the kettle, they begin to work it, by rolling and unrolling it again and again, first with their hands, and then with a little wooden roller, dipping it frequently in the kettle, till by fulling and thickening it in this manner for four or five hours, it is brought into the size of the hat intended; they form the crown by laying the high crowned cap on a wooden block of a proper size, and tying it round with a packthread, called a commander, which they gradually push down to the bottom of the block, with a piece of iron properly bent, which they call a stamper. When the hat is dried, they singe it, and rub it with pumice, to take off the coarser knap, it is afterwards rubbed with seal-skin, and lastly carded with a fine card.

*Mr. HARCOURT.* You have given us a very clear account of what you saw this morning; but pray tell us, whether something is not to be done to colour and stiffen the hat.

*CHARLES.* O yes! the hat is sent upon the block

to the dyer's, who makes a dye of log-wood, verd-grease, copperas, and alder-bark, and fills his copper with it, which is mostly large enough to hold ten or twelve dozen of hats at a time. He boils the hats in this dye for near an hour, then sets them out to cool, and boils them again ten or more times over, till the dye is complete; it is now returned to the hatter, who dries it thoroughly over a charcoal fire, and then smears it with glue, or gum senegal dissolved, to stiffen it. The next thing is to steam it on the steaming-bafon, which is a little hearth or fire-place, covered over with an iron plate that exactly fits it; on this plate, wet cloths are spread to prevent the hat from burning, the hat is placed brim downwards on it, and rubbed gently with the hand, till sufficiently steamed, and dried; it is then put again upon the block, and brushed and ironed with flat-irons, such as are used for ironing linen, which smoothens and polishes it, and nothing now remains to be done, but to clip the edges, and sew a lining into the crown.

*Mrs. HARCOURT.* I thank you in the name of the company for the entertainment you have given us, and cannot help observing the wisdom of Providence, that has so wonderfully suited the formation and instincts of the beaver to its wants, and appointed manner of life.

*AUGUSTA.* I am all astonishment and wonder; and for the future, shall be more ready to listen to extraordinary things with attention; but I thought it foolish to give credit to any thing that seemed so improbable.

*Mrs. HARCOURT.* There is a material difference between credulously assenting to every thing we hear without examination; and listening attentively to the relations of people of sense and credit, who have no motive for imposing upon us; and, who if we have patience, will probably give good reasons for what they assert; but it is a mark of ignorance to believe every thing implicitly. Much depends upon the

degree of credit due to the character of the person who relates the circumstance : but there are such wonders in both nature and art, that till they are explained, may well appear improbable to the uninformed mind ; this reflection should incite us to pursue the attainment of useful knowledge, by attending to the conversation of people of experience and information.

*Mr. HARCOURT.* Conversation is an agreeable means of instruction : and those people, who by a habit of attention and observation, collect knowledge wherever it is to be found, may meet with it from the most clownish rustic, or unlettered mechanic. Never despise any body as too mean to learn from ; but talk to every one in his own way ; that is, on the subject of his profession or calling, and you may with certainty rely upon gaining information.

*Mrs. HARCOURT.* We have passed the time so pleasantly, that we have not been aware how late it is ; it is time to take leave. Children, good night.

## CONVERSATION VII.

*Mrs. HARCOURT.* **B**USINESS prevents your father from his usual attendance, therefore we must find something to entertain ourselves with ; cannot we contrive some game or play to amuse us ?

*SOPHIA.* If you please, mamma, we will play at questions, in the manner Miss Groves shewed us. You must propose a question, which each of us must try to answer in turn. Whoever gives a proper reply gains a prize.

*CECILIA.* What shall the prizes be ?

*CHARLES.* They need not be of any great value, some trifle for the sake of the play.

*Mrs. HARCOURT.* I received a present yesterday, of some shells and fossile productions, it will give me pleasure to distribute them among you ; they will

just suit the purpose. Sophia, you will find them in my cabinet : bring them, and dispose them in equal parcels.

*SOPHIA.* What beautiful tints! what colours can equal these? Shells, flowers, and insects are the finishingings of nature, and for elegance of form, variety, and beauty of colour, as well as delicacy of texture, excel the finest works of art.

*Mrs. HARCOURT.* They will serve two purposes. The one as prizes for your answers, the other as a subject for my first question. What is a shell?

*HENRY.* A shell is a house for a snail or a small fish to live in.

*Mrs. HARCOURT.* A prize belongs to Henry for his answer, as it is certain that shells furnish a case or covering, or if you please a habitation, for the insects that dwell in them; they also serve them as a defence, or coat of mail against their enemies, or any thing that might injure their tender bodies; but I mean to enquire in what manner the shell is produced.

*CECILIA.* I suppose it is a part of the animal formed with it as bones are.

*Mrs. HARCOURT.* That was thought to be the case formerly, but the discoveries of Mr. Reaumur has shewn the supposition to be false; he has proved that the shells of snails are formed from the perspiration of the animal, which is concentered or hardened by the air; and it is reasonable to suppose that the sea-water has the same effect on those of fishes. The casting of the shell of crabs and lobsters tends to confirm this opinion.

*AUGUSTA.* Do they ever change their shells?

*Mrs. HARCOURT.* Yes, my dear, every year. The creature, aware of what it has to undergo, retreats to a place of security, such as the cavities of rocks, or under great stones, where it lies till all the parts are by degrees disengaged from the old shell. In this naked state they make a very disagreeable appearance, being a mere lump of flesh covered with a

sort of jelly, which by degrees hardens into a shell, somewhat larger than the old one, and thus accommodates itself to the growth of the animal.

*CHARLES.* This is very wonderful indeed; are shells a perfect defence to the fish, that live in them?

*Mrs. HARCOURT.* I propose that as my next question, to be answered by the company,

*SOPHIA.* I suppose there is no manner of doubt, as mamma has already told us, that they defend the fish against many injuries; but I read a little while ago, that they are not a perfect security against all. Shell-fish are the food of some fish of the larger kinds, particularly the sea-porcupine, and a species of the wray-fish, feed chiefly upon them. These fish are provided by nature with a suitable apparatus for grinding them into a state proper for digestion, their jaws being furnished with bony substances extending to the palate, and under part of the mouth, which are capable of reducing strong shells into a pulp; but what is most extraordinary is, that a small pectunculus or cockle, is the prey of the foal, which has no such instruments for breaking them to pieces, but is supposed to be furnished with a menstruum in the body, that has the power of dissolving them; for on examining the inside of a foal, many of these shells are found in part dissolved, whilst others remain unaltered.

*Mrs. HARCOURT.* How various are the powers of nature; she is not obliged to perform the same thing always by the same means, but uses variety of processes to produce the same effect. Into how many classes are shells divided by the best naturalists?

*CHARLES.* A visit to the British Museum, in company with a friend of my papa's, who is a collector of shells, has rendered me capable of resolving that question; they are generally divided into three classes; Univalves, bivalves, and multivalves; which include sea, land, and fresh-water shells, which are subdivided into many genera and species. The first class consists of shells that are of one single piece; as a

snail-shell; the second, of those which are formed of two, as the oyster or muscle; and the third, of those which have more pieces than two. Sea-eggs will afford us an example of these, being covered with spines or prickles. Land-shells are of two kinds, the recent and the fossil; the recent are those which are inhabited by living animals; but the fossil are the remains of marine bodies, supposed to have once inhabited the deep seas, though frequently found in great quantities under ground, in mines, and in places far distant from the ocean, and sometimes on the tops of mountains.

*AUGUSTA.* Astonishing! by what strange accident could they ever come there?

*CHARLES.* That question has puzzled many wise and learned men; it is generally believed that those parts have many ages ago been covered with sea, and some refer to the grand deluge as the cause of this wonderful change; they are very advantageous to the places where they are found, as they afford an excellent manure for land.

*SOPHIA.* This is a convincing proof of the truth of the history of the deluge: the account that Moses gives us of the flood has always appeared to me so wonderful, that I could scarcely believe it; but I think, after this confirmation, I shall never doubt again concerning any thing, however extraordinary, that I find written in the Scriptures.

*Mrs. HARBOUR.* Remember, my dear, that the sacred writings contain a history of the miraculous interposition of Divine Providence, in teaching mankind the most holy and pure religion, from the earliest ages to the glorious dispensation of the Gospel. Can we then be surprised, that they should contain things out of the course of nature? the very essence of a miracle is, that an effect is produced which can only be accounted for by the influence of a supernatural power. In the rude ages of gross ignorance, when the worship of idols was almost universal, some striking instances of a miraculous display of divine

power was necessary to convince men, that a God existed, who had created all things, and who governed them with an all-seeing eye. The children of Israel were chosen as a peculiar people, among whom were displayed these extraordinary manifestations of the divine Presence, that by their means the worship of the One True God might supplant the adoration paid to the sun, moon, stars, animals of various kinds, and even to stocks and stones, by the different nations of the earth. The multitude of fossil bodies found in places remote from the sea are an incontrovertible proof of some violent convulsion of nature, and perhaps are permitted to remain as a monument, to silence all cavillers on this subject; but let us resume the thread of our discourse: the vast variety of shells that are seen in the cabinets of collectors are not all the produce of one sea or one country. Some of the most beautiful come from the East-Indies and the Red-Sea. The colours and brilliancy of shells seem to be improved and heightened by the heat of the sun; as those of warm climates always excel those found in cold countries in lustre. The shores of Asia furnish us with the pearl-oysters and scallops in great perfection. Shells of great beauty are also found on the shores of America and the West-Indies. In Africa, on the coast of Guinea, abounds a small species of porcelain shells, which the natives use as money.

*AUGUSTA.* I thought nothing could serve the purpose of money but gold and silver.

*Mrs. HARCOURT.* Gold and silver are only used as a representation of real wealth. I give you a certain quantity of gold, in exchange for which you supply me with corn, cattle, or any of the necessaries of life. With the gold that you have received, you purchase some other commodity that you want from a third person, who likewise barter it in the same manner for something that he stands in need of; thus it passes from one to another, enabling them to exchange the commodities of life in a more exact



proportion, with respect to the value of each, than could be done without such a medium. Shells, or any other durable substance, may answer the same purpose as gold, if men agree to receive it in the same way. The women of this country adorn their hair; and make bracelets and necklaces with another kind, which are perfectly white.

*HENRY.* How droll they must look upon their black faces and necks:

*SOPHIA.* We have different ideas of beauty, Henry; perhaps they are as well satisfied with these simple ornaments, as our women of fashion are with diamonds and rouge, but we interrupt mamma.

*Mrs. HARCOURT.* The Mediterranean and Northern Ocean contain great variety of shells, and many of remarkable elegance and beauty; but upon the whole they are greatly inferior to those of the East-Indies. Our own English coasts are not the last in the production of shells, though they cannot be compared to those of the East-Indies for lustre and colour.

*CECILIA.* I think I have heard that there is a method of polishing shells; mamma; will you be so kind as to tell us how it is done.

*Mrs. HARCOURT.* There are various methods of polishing shells, and adding to their natural beauty. Among the immense variety of shells with which we are acquainted, some are taken out of the sea, or found on its shores, in their utmost perfection, and cannot be improved by the hand of art, their beautiful tints being spread upon the surface, and the natural polish superior to any that could be given: but in others the beauties are concealed by a coarse outer coat, which the hand of a skilful polisher may remove. Collectors should have specimens of the same species, both rough and polished, that the naturalist may compare the natural state with the artificial one. How many fine strokes of nature's pencil in this part of the creation would be entirely concealed from our view, were it not for the assistance of an art that unveils and displays them.

in full lustre? A shell that has a smooth surface, and a natural dull polish, requires only to be rubbed with the hand, or a piece of chamoy leather, or some tripoli or fine rotten stone may be used, and it will become perfectly bright and polished; but even this should be done with caution, for in many shells the lines are only on the surface, and the wearing ever so little of the shell defaces it. A shell that is rough, foul, and crusty, or covered with a tartareous coat, must be steeped for some hours in hot water, then it is to be rubbed with rough emery on a stick, in order to get off the coat; after this it may be dipped in diluted aqua-fortis, spirit of salt, or any other acid, and after remaining a few moments in it, be again dipped in common water; then it is to be well rubbed with soap-suds; after which the operation may be finished with fine emery, and, a hair-brush; and many, to heighten the polish, rub the shell with a thin solution of gum arabic, or the white of an egg; gloves should be worn in using the aqua-fortis, as it is liable to injure the flesh wherever it touches. Some shells require more severe treatment, which is called scaling them, and is performed by a horizontal wheel of lead or tin, impregnated with rough emery, and the shell is worked down in the same manner as stones are by the lapidary; this requires the hand of a skilful artist to avoid wearing away the shell too low, and spoiling it. After the shell is cut down as far as is proper, it is to be polished with fine emery, tripoli or rotten stone, with a wooden wheel, turned by the same machine as the leaden one. These are the principal means used in this art, and the changes produced by it, are often so great, that the shell is not to be known for the same; for instance, the onyx or volute is of a simple pale brown in its natural state, and becomes a fine bright yellow, with only just the superficies taken off; but if eaten away deeper, appears of a milk white, with a bluish hue towards the bottom. In the East-Indies they frequently engrave lines, circles, and other devices on many species of

shells, particularly the nautilus; but this is a gross violation of good taste; so far from embellishing or heightening the charms of nature, it does not even imitate them.

*CHARLES.* When we go to the sea-side, in autumn, we may collect shells, and polish them at our leisure hours. Among other curiosities that were pointed out to my observation, at the British Museum, was a piece of byffus, which is a fine cloth, used by the ancients, when silk was rare, made of the threads of the pinna marina, a fish somewhat like a muscle, but much larger, and is held in its place in the same manner, by a prodigious number of very fine threads, which the animal has the power of spinning as it finds occasion, as the spider and caterpillar do. These threads have in all times been used for the same purposes as silk. At present they are manufactured at Palermo, the chief city of Sicily, and other places, into gloves, stockings, and different sorts of wearing apparel. The method of rendering it fit for use, is by laying it for a few days in a damp cellar to soften, then comb and cleanse it; and lastly spin it, in the same manner as they do silk. By these threads, the pinna marina, or sea-wing, as it is sometimes called, suspends itself to the rocks twenty or thirty feet beneath the surface of the sea. In this situation, it is so successfully attacked by the eight-footed polypus, that the species could not exist, but for the assistance of the cancer pinnotheris, which lives in the same shell, as a guard and companion. The pinnotheris or pinnophylax is a small crab, naked like Bernard the hermit, but is furnished with good eyes, and always inhabits the shell of the pinna; when they want food, the pinna opens its shell, and sends its faithful ally to forage; but if the cancer sees the polypus, he returns suddenly to the arms of his blind hostess who, by closing the shell, avoids the fury of her enemy; otherwise, when it has procured a booty, it brings it to the opening of the shell, where it is admitted, and they divide the prey.

*AUGUSTA.* This is curious indeed; that one animal should supply eyes for another, in return for the advantage of a coat of mail.

*Mrs. HARCOURT.* It is almost time to distribute the prizes. Henry, that small lot of beautiful shells belongs to you. Charles will take these pieces of coral, and prepare himself by to-morrow evening to give us some account of the nature of coral, whether animal or vegetable; and Sophia, this paper nautilus is reserved for you. I hope you are able to give us some particulars relative to the fish that inhabited it.

*SOPHIA.* The general form of the nautilus is adapted to swimming on the water, and resembles the figure of a boat or vessel, but varies in some particulars in the different species. The name is derived from a Greek word, signifying both a fish and a sailor. It is supposed that men first took the idea of sailing in vessels from what they saw practised by this little creature. The paper nautilus is so named from the thinness of the shell, which it sometimes creeps out of, and goes on shore to feed. When this animal intends to sail, it extends two of its arms on high, and supports a membrane between them, which it throws out to serve as a sail, and its two other arms hang out of the shell to be used occasionally as oars, or as a steering; but this last office is generally performed by the tail. When the sea is calm, numbers of these fish are frequently seen diverting themselves with sailing about in this manner, but as soon as a storm arises, or any thing disturbs them, they draw in their arms, and take in as much water as makes them a little heavier than the sea-water in which they swim, and by that means sink to the bottom. When they desire to rise again, they expel this abundant water through a number of holes which they have in their arms, and so lighten themselves.

*Mrs. HARCOURT.* The manners and instincts of those animals that inhabit the ocean, are greatly concealed from us by their situation, but those few, that have offered themselves to our observation, dis-

play instances of the same admirable wisdom that has formed the inhabitants of the earth and air. Should man ever be enabled, by any future discovery to traverse the bottom of the sea, what wonders would be opened to his view ! what numberless examples of contrivance and sagacity, directed by the same wisdom, that has instructed the bee to gather honey, and the beaver to construct his habitation, would appear ! The different contrivances that several species of fish, whose manners are known, discover, in the modes of catching their prey, are so wonderful and curious, that I cannot deny myself the pleasure of relating a few instances. The sturgeon is without teeth, and his mouth placed under the head, like the opening of a purse, which he has the power of pushing suddenly out, or retracting. Before this mouth, under the beak or nose, hang four tendrils some inches long, and which so resemble earth-worms, that at first sight they may be mistaken for them. This clumsy toothless fish is supposed by this contrivance to keep himself in good condition, the solidity of his flesh evidently shewing him to be a fish of prey. He is said to hide his large body amongst the weeds near the sea-coast, or at the mouths of large rivers, only exposing his irri or tendrils, which small fish or sea insects mistaking for real worms, approach for plunder, and are sucked into the jaws of their enemy. The flesh of the sturgeon was so valued in the time of the emperor Severus, that it was brought to table by servants with coronets on their heads, and preceded by music, which might give rise to its being in our country presented by the lord mayor to the king. At present it is caught in the Danube and the Wolga, the Don, and other large rivers, for various purposes. The skin makes the best covering for carriages ; isinglass is prepared from parts of the skin, cavear from the spawn ; and the flesh is pickled or salted, and sent all over Europe, as your father told you in his account of the fisheries. There is a sea insect described by Mr. Huges, whose claws or ten-

tacles being disposed in regular circles, and tinged with variety of bright, lively colours, represent the petals of some most elegantly fringed, and radiated flowers; as the carnation, marigold, and anemone; these beautiful rays serve them as a net for inclosing their prey. These entertaining subjects have insensibly led us on till it is late: Good night, children, let us retire.

### CONVERSATION VIII.

*Mr. HARCOURT.* **G**OOD evening to you, ladies, I regretted losing the pleasure of joining your party last night, but understand from Mrs. Harcourt, that you were very well amused, with the subject of shells and fossils.

*CECILIA.* Nothing was wanting but your company, to render our evening delightful.

*Mrs. HARCOURT.* Delightful, my dear Cecilia, that is too strong a word; learn to moderate your expressions, suit your terms to the occasion; or you will be at a loss to raise your language in proportion to your feelings, when important events excite your liveliest emotions.

*CECILIA.* How often do I forget your precepts in this respect, although I endeavour to attend to them; but I did enjoy myself so very much last night, that I thought I might say delightful, without any exaggeration.

*Mrs. HARCOURT.* I am glad you were so well pleased; but restrain the warmth of your expressions; an excess in this way, may be ranked among the follies of the present fashionable manners; it is not only absurd in itself, but tends to give us false ideas of things, and induces us to consider that as important, which in its own nature is but trifling. Whenever I hear a girl exclaim, upon every little variation of weather, I am dying of heat, I am frozen to death; or melting in extacies at a concert or

a play, I suspect either that her imagination has been suffered to run wild, or that she has never been instructed to adapt her language to her ideas. Such excess of speech is to be expected from novel and romance readers, but are ill suited to a woman of good sense and propriety of manners.—Well, Charles, we expect our entertainment from you, to night. Have you been able to discover, whether corals and corallines are to be ranked in the vegetable or animal kingdom?

*CHARLES.* Linnæus has classed them among the zoophytes, which are a kind of intermediate body, supposed to partake both of the nature of an animal and a vegetable, as the Greek word from which it is derived, indicates, signifying plant animal. In the Linnæan system, the zoophytes, which constitute the fifth order of worms, are composite animals, resembling flowers, and springing from a vegetating stem. This order contains fifteen genera, of which nine are fixed, and have no power of removing from the places where they are formed; as the isis or red coral, sea-fan or gorgonia, alcyonium, sponge, flustra, tubularia, corallines, fertularia, and vorticella; but the others possess the faculty of transporting themselves from one place to another, as the hydra or polype, the pennatula or seapen, tœnia, volvox, furia, and chaos, or the assemblage of chaotic or microscopical animals. The species under this order are one hundred and fifty-six. The immense and dangerous rocks built by the swarms of coral insects in the Southern Ocean, which rise perpendicularly like walls, are described in Cook's Voyages. A point of one of these rocks broke off, and stuck in the hole that it had made in the bottom of one of the ships, which must otherwise have perished by the admission of water.

*MR. HARCOURT.* Their prodigious multiplication in all ages of the world is shewn by the numerous lime-stone rocks, which consist of a congeries or heap of the cells of these animals, which constitute a great part of the solid earth. Specimens of these rocks are

to be seen in the lime-works at Linsel, near Newport, in Shropshire; in Coalbrook Dale; and in several parts of the Peak of Derbyshire. It is remarkable that many of those found in a fossile state, differ from any species of the recent ones that are known, and have either been produced in the deep seas, where no human eye can penetrate, or are become extinct. I suppose, Charles, you can inform us from what country the best coral comes, and in what manner it is procured.

*CHARLES.* The fishing season for coral is from April to July. The places are the Persian Gulf, Red Sea, coasts of Africa, towards the Bastion of France, the isles of Majorca and Corsica, and the coasts of Provence and Catalonia. Seven or eight men go in a boat: the caster throws the net, which is formed of two beams, tied across with a leaden weight to press them down. A great quantity of hemp is loosely twisted round, among which they mix some strong nets, and fasten to the beams; thus prepared it is let down into the sea, and when the coral is pretty much entangled, they draw it out by a rope, which sometimes requires half a dozen boats to effect. It is used as a medicine in various diseases.

*SOPHIA.* I suppose it is but lately that the real nature of coral has been ascertained; was it not formerly reckoned a vegetable?

*Mr. HARCOURT.* It was formerly ranked among the number of marine plants, but the discoveries of modern naturalists have raised it to the animal kingdom, since their observations satisfactorily prove that it is the structure and habitation of certain sea animals, and designed for their protection and support. The nature and origin of coral have been as much disputed as any subject in natural knowledge. Some have considered coral, and the other similar productions of the sea as stone. They adopted this opinion from their excessive hardness, and specific gravity, as well as from observing that when these bodies were calcined, they were converted into lime. Kircher



supposes that there are entire forests of it at the bottom of the sea, which is not at all improbable, since M. de Peyssonnel has demonstrated, by his experiments, that it is constructed by an animal of the polype kind. In forming coral, and other marine productions of this class, the animal labours like those of the testaceous kind, each according to its species, and their productions vary according to their several forms, magnitudes, and colours. The coral insect, he observes, expands itself in water, and contracts itself in air; or when it is touched with the hand, or when acid liquors are poured upon it; and he actually saw these insects move their claws or legs, and expand themselves, when the water in which they were, was placed near the fire. Broken branches of coral have been observed to fasten to other branches. The coral insects, not having been injured, continue their operations, and as they draw no sustenance from the stone of the coral, they are able to increase in a detached state. M. de Peyssonnel observed that it grows in every direction, sometimes horizontally, sometimes perpendicularly downwards, at other times upwards. Coral then is a mass of animals of the polype kind, having the same relation to the polypes united to them, that there is between the shell of a snail, and the snail itself. Pray, Charles, tell us how many kinds of coral there are?

CHARLES. There are three kinds; red, white, and black; the black is the rarest, and most esteemed; but it is the red that is mostly used in medicine. There is no part of the world where white coral is produced in such abundance as on the shores of the island of Ceylon, and other of the neighbouring coasts. The lime made in those countries for building houses, fortifications, &c. is all prepared by burning this coral. It lies in vast banks, which are uncovered at low water, and it is spongy and porous. While young, it is formed erect in shape of little shrubs, and is then firm and solid, with a smooth surface; but the branches continually shoot out, and

from those new branches proceed others, till the whole is one confused bush, which is all covered with a white viscous matter, which in time hardens upon them, and becomes coral; and this filling up all the interstices, and hardening between them, renders it one coarse rock.

*CECILIA.* I observed you named sponge among the zoophytes; surely that cannot be the habitation of insects. I have often wondered what it is, but have never been able to satisfy my curiosity.

*Mr. HARCOURT.* Sponge is a kind of marine substance, found adhering to rocks, shells, &c. under cover of the sea-water. Naturalists have till lately been greatly embarrassed in which of the three kingdoms to place it; but it is now decidedly allowed to be of some species of worm or polype. The same M. de Pcyssonnel has discovered, and described the worms that form four different species of sponges; he thinks the sponge is formed from the juice or slaver, which is deposited by the worms that inhabit them.

*HENRY.* The next time I have any to rub my slate with, I will try if I can find any of these insects.

*Mrs. HARCOURT.* It will be a vain endeavour. The insects are all dead, long before the sponge comes to our hands; besides they are so small as to require the best microscopes to discover them.

*AUGUSTA.* I know a lady that has a beautiful grotto in her garden ornamented with a variety of corals and shells. I shall observe it with more attention the next time I visit her.

*CHARLES.* I wonder any body should bestow the money and trouble, necessary to form such a collection, to place them in a garden, where they are liable to be stolen, and are exposed to the injuries of the weather.

*SOPHIA.* Perhaps the corals are artificial, and ordinary shells, mixed with pebbles, and pieces of coloured glass; the refuse of the glass-house, would have a very pretty effect.

*CECILIA.* Artificial coral! I never heard of such a thing. Pray, sister, how do they make it?

*SOPHIA.* After having chosen twigs and branches to your fancy, resembling the manner of the growth of coral as much as possible; you must peel and dry them. Then take one ounce of clear rosin, and dissolve it in a brass pan, to which add two drams of the finest vermilion, mix these ingredients well together, and paint the branches with it whilst it is warm, then hold them over a gentle coal fire, till they are smooth and even, as if polished. In the same manner, white coral may be imitated with white lead, and black coral with lampblack.

*CHARLES.* If papa and mamma will give us leave, we will build one near the river, at the top of the grove. I will undertake to be the architect, and perform the rough work.

*Mrs. HARCOURT.* I approve the plan, and will assist in the execution of it.

*Mr. HARCOURT.* I agree to it, on one condition, that it shall not infringe upon the time of your studies. Rise an hour earlier every morning, that will give you sufficient opportunity for the work.

*CECILIA.* That will be no hardship, these beautiful mornings; let us agree to meet at six o'clock.

*AUGUSTA.* I am not used to rise till eight. How shall I ever contrive to be ready?

*HENRY.* I will rouse you, by ringing of the bell.

*Mrs. HARCOURT.* Late rising is a bad habit, that you have been allowed to contract; but my dear Augusta, determine to overcome it; it will require a little resolution at first, but when you consider the advantages it will procure, I am persuaded the difficulty will appear trifling. Health and opportunity for improvement, result from an early hour; a pale face, languor, and slothfulness, are the penalties of lying long in bed. A too great proportion of sleep is equally a species of intemperance with gluttony and drunkenness, and yet many persons, who would shudder at being accused of those depravities, freely

indulge themselves in the former, from want of consideration, ill example, and long habit; and by that means injure their constitutions, and lose a large portion of the active part of their lives. Perhaps the building of this grotto may be the fortunate means of accustoming you to wake at a proper hour, and when once you have used yourself to it, you will find it both pleasant and profitable.

*AUGUSTA.* You have convinced me of the advantage of rising early, and I shall endeavour to be one of the first at the grove. Papa has lately given me a fine pearl necklace that was mamma's; my governess tells me that they are not beads, but that they are found in oysters. I thought I would enquire the next time we met, how they came there, as I suppose they are no part of the fish.

*MR. HARCOURT.* Many have been the conjectures of both ancient and modern writers concerning the production of pearls. Some have supposed them to proceed from a disease of the fish; but there seems to be a great similarity between them, and what is found in crabs, called crabs-eyes, which are formed near the stomach of the animal, and serve as a reservoir of calcareous matter against the forming of a new shell, at which time they are dissolved, and deposited for that purpose. As the internal part of the shell of the pearl, oyster, or muscle, consists of mother pearl, which resembles the material of pearl, and as the animal has annually occasion to enlarge his shell, there is reason to suspect that the loose pearls are similar reservoirs of the pearly matter for that purpose. The fish, in which the pearls are found, is much larger than the common oyster, and is called *concha margaritifera*. It abounds on the coast of Persia, near Ormus, about Cape Cormorin, and on the coast of the island of Ceylon. The oriental pearls are most valued on account of their largeness, colour and beauty; but pearls are caught in the seas of the East-Indies, in those of America, and in some parts of Europe. At the commencement of the season, which

is in March and April, and again in August and September, there appear frequently two hundred and fifty barks on the banks ; in the larger are two divers ; in the smaller, one. Each bark puts off from shore before sun-rise, by a land-breeze which never fails, and returns again by a sea-breeze, which succeeds it at noon. As soon as the barks have arrived at the place where the fish lie, and have cast anchor, each diver binds a stone under his body, which is to serve him as ballast, and prevent his being driven away by the motion of the water, and also to enable him to walk more steadily among the waves. Besides this, they tie another heavy stone to one foot, in order to sink them to the bottom of the sea : and as the oysters adhere strongly to the rocks, they arm their fingers with leather gloves, or take an iron rake to displace them with. Lastly, each diver carries with him a large net, tied to his neck by a long cord, the other end of which is fastened to the side of the bark. The net or sack is intended to hold the oysters he may collect, and the cord is to pull him up by, when his bag is full, or when he wants air. Thus equipped, he precipitates himself, sometimes above sixty feet under water. As he has no time to lose, as soon as he arrives at the bottom, he begins to tear the oysters off the rocks, and cram them into his budget. At whatever depth the divers are, the light is sufficient for them to see what passes around them, and sometimes, to their great consternation, they behold monstrous fishes, from whose jaws they can escape only by mudding the water, and concealing themselves by that means ; although this artifice will not always save them from falling a prey to these formidable enemies. The best divers will remain under water near half an hour, during which time they hold their breath, without the use of oils, acquiring the habit by long practice ; but the exertion is so violent, as generally to shorten the lives of those who repeat it frequently. Besides this method of diving, there is a way of descending in a diving bell,

so contrived as to be replenished often with fresh air, by means of air-barrels, which are let up and down by ropes.

*SOPHIA.* The dangers that the poor diver incurs, to obtain a mere bauble, for I suppose pearls are only used for ornaments, are far more dreadful than those of the Greenland fishermen.

*Mrs. HARCOURT.* The poor men, who encounter these dangers for a livelihood, do not consider how trifling the value of the pearls is in itself, but what great advantages they can gain by the risk. Single pearls have been sold for immense sums of money. Cleopatra, Queen of Egypt, wore one as an ear-ring, that Pliny has estimated at eighty thousand pounds sterling. The real value of pearls and diamonds is small, because they do not contribute to the support or comfort of the life of man; but whilst people of fortune will lavish great sums upon such insignificant things, there will always be found people, whose necessities will impel them to obtain them at the risk of their lives. It is time to separate. Remember our appointment in the grove at six to-morrow morning.

## CONVERSATION IX.

*Mr. HARCOURT.* **W**ELL, ladies, how have you proceeded with your grotto? though I am not one of the party, I am interested in your success.

*SOPHIA.* We go on very well indeed, Charles has drawn the plan, and mamma has given James leave to help my brother to dig the foundations; Augusta and Cécilia are employed in sorting and cleaning the shells and fossils; they also have undertaken to collect pebbles, and gather mosses, attended by little Henry, who carries a basket to put them in; and I am very busy in making artificial coral; thus we all take a share. Mamma is so kind as to promise us a present of shells and ores; and, if you please, you

must contribute, by procuring us some glass cinders, or refuse of the furnaces from the glass-house.

*Mr. HARCOURT.* Most willingly shall I supply you with that, or any other thing you may want, to forward your design; but pray, can any of you inform me, of what ingredients glass is composed?

*CHARLES.* I think, Sir, you have told me that the principal articles in its composition are salt and sand, or some kind of stone which answers the same purpose; the salt must be of the fixed kind, such as will not evaporate with the most intense heat, and is generally procured from the ashes of a vegetable called kali, which is brought from the Levant. The sand or stone, must be such as will melt easily, which gives firmness and consistence to the glass.

*Mr. HARCOURT.* The best stone for this purpose, comes also from Italy, and is called tarso. But sand is now almost the only substance employed in the British manufactures of glass. The most suitable is that which is white, small, and shining; when examined by the microscope, it appears to be fragments of rock crystal; that which is of a soft texture, and more gritty, does very well for green glass. Our glass-houses are furnished with white sand for their crystal glasses, from Lynn in Norfolk, and Maidstone in Kent; and with the coarser, for green glass, from Woolwich; other ingredients are occasionally mixed with these, according to the kind of glass required, such as arsenic, manganese, lead, &c.

*Mrs. HARCOURT.* Sophia, you have seen a glass-house, cannot you give some account of the operations performed there?

*SOPHIA.* There are three sorts of furnaces used in the glass-works. After having properly mixed the ashes and sand together, they are put into the first furnace, where they are burned or calcined for a sufficient time, and become what is called frit, which being boiled in pots or crucibles of pipe-makers clay, in the second furnace, is rendered fit for blowing.

*AUGUSTA.* How very extraordinary that materi-

als of so gross and dirty a nature, should ever become so beautiful and transparent as glass! By what is the alteration occasioned?

*Mrs. HARCOURT.* The metamorphosis, for it may well be termed so, is caused by the action of the fire, which when intense, vitrifies or turns them into glass. Sophia, go on with your account.

*SOPHIA.* The workman, who blows the glass, takes his blowing iron, which is a hollow tube about two feet and a half long, and dipping it in the melting-pot, turns it about: the metal sticks to the iron like honey: he dips four times for every glass, and at every dip, rolls the end of his instrument, with the glass on it, on a piece of iron, over which is a vessel of water, which by its coolness consolidates the glass, and disposes it to bind better with the next to be taken out of the pot. When he has got enough of matter on the instrument, he begins to blow gently through it, in the same manner as boys blow soap-buds through a pipe, and in order to give it a polish, he rolls it backwards and forwards on a stone or marble: after blowing, and whirling the iron till he has formed the glass to the intended shape, he delivers it to the master workman to break off the collet, which is a little piece that sticks to the iron. In order to hollow it out, another workman thrusts in an iron instrument, and turns it round with a circular motion till it is sufficiently enlarged: When it is perfectly formed, it is set in the lear or third furnace to anneal or harden; it is proper to add, that the stem, and the foot of a drinking glass, require each a distinct operation.

*Mrs. HARCOURT.* Habit and long practice enable these men to endure these scorching heats, which they receive directly in their faces, mouths and lungs. They are always obliged to work in their shirts, with a broad brimmed straw hat on their heads, to preserve their eyes from the excessive heat and light. They sit in large wide wooden chairs, with long elbows, to which their instruments are hung. They



work for six hours without intermission, when they are relieved by another set of workmen, who take their places for the same space of time.

*CECILIA.* Panes of glass for windows cannot surely be formed by blowing, pray how are they made?

*Mr. HARCOURT.* The workman contrives to blow, and dispose his glass so as to form a cylinder, which by frequent heating and working on a kind of earthen table, at length begins to open and unfold like a sheet of paper, a previous notch or incision being made for that purpose in the cylinder of glass, and thus it becomes flat; the table of glass is now nearly perfected, and requires nothing farther, but to be heated over again. When taken out, they lay it on a table of copper, from whence it is carried to the third furnace to anneal.

*HENRY.* Pray explain the meaning of that word, I do not understand it.

*Mr. HARCOURT.* It signifies to bake or harden; the first furnace in a glass-house is heated to an intense degree of heat, in order to fuse or incorporate the ingredients; the second is also heated sufficiently to melt and vitrify the frit into a glassy substance; but the third is moderately heated, that it may perform the office of baking or hardening the work, when fashioned to the shape it is to bear.

*HENRY.* You have explained this so clearly, that I am no longer at a loss to comprehend it.

*Mr. HARCOURT.* There are two methods of making plates for looking-glasses; the one, by blowing them much in the same manner as they blow glass for windows, but on a larger scale. The other, casting or running of them, which is generally practised in making large glasses. The French claim the honour of this invention. It was first proposed to the French court in 1588, by the Sieur Abraham Thevart. It is performed in nearly a similar manner to the casting of sheet-lead, and this method not only enables them to make glasses of more than double the size of any made by blowing, but also to cast all

kinds of borders, mouldings, &c. The furnaces for melting the materials of this manufacture are of enormous size, and those for annealing the glasses, when formed, still larger. There are at least twenty-four annealing furnaces or ovens, each above twenty feet long, placed around a melting furnace. All these furnaces are covered over with a large shed, under which are likewise built forges and workhouses for smiths, carpenters, and other artificers, who are continually employed in repairing and keeping in order the machines, furnaces, &c. as also apartments for these, and the workmen employed about the glass. So that the glass-house in the castle of St. Gobin, in the forest of Fere, in the Soissonois, celebrated for its excellence in this manufacture, appears more like a little city, than an assemblage of workmen's sheds. The insides of the furnaces are lined with a sort of baked earth, adapted to sustain the action of fire, and the same earth serves also for melting-pots, cisterns, &c. The cisterns are about a yard long, and half as wide, they serve for the conveyance of liquid glass, which is drawn out of the melting-pots, to the casting tables. When the matter is sufficiently vitrified, refined, and settled, they fill the cisterns, and leave them in the furnace, till they appear white through excessive heat. The table on which the glass is to be run, is of cast iron. There is a curious machinery to remove the cisterns from the furnaces to the table, which places them in an inclined position, so as to discharge a torrent of matter, like liquid fire, with which the table is presently covered. As soon as the glass is come to a consistence, they shove it off into the annealing furnace, with an iron raker as wide as the table, being assisted by workmen on the other side of the furnace, who pull it to them with iron hooks.

*CHARLES.* I cannot imagine how they contrive to remove them in that burning state, without either breaking the glasses, or hurting themselves.

*Mr. HARCOURT.* The surprising dexterity and

quickness with which they perform the different operations, is inconceivable to those who have not been eye-witnesses of that wonderful manufacture. The tilters, or persons employed in heating the large furnaces, run round the furnace in their shirts, without the least intermission, with a speed scarcely inferior to that of the lightest courier: as they go along, they take two billets of wood, and throw them into the first furnace, and continuing their course, do the same for the second. This they hold on uninterruptedly for six hours together. One would not expect, that two such small pieces of wood, which are consumed in an instant, would maintain the furnace in the proper degree of heat, which is so great, that a large bar of iron, laid at one of the mouths of the furnace, becomes red hot in less than half a minute. The process of these glasses is now completed, except grinding, polishing, and foliating, or laying on of the quicksilver. The grinding of glass requires great nicety, when performed on glasses that are designed for telescopes, or other optical uses. Plate or cast glass is ground by placing it on a stone table, in such a manner, that it cannot be shaken or displaced, and then by means of a wooden frame, another glass is rubbed backwards and forwards over it, with water and sand between them, and thus by constant attrition their surfaces become smooth.

*Mrs. HARCOURT.* Various are the uses to which the ingenious invention of glass is applied; besides the different accommodations with which it supplies domestic wants, such as windows, looking-glasses, and all the innumerable variety of vessels that adorn our tables, and contribute to our convenience. Natural philosophy is greatly assisted by telescopes, microscopes, magnifying glasses, &c. which enable us to view objects too minute, or too distant ever to be examined by the naked eye. Many experiments in electricity, and on the properties of the air, the knowledge of which is called pneumatics, could not be performed without the assistance of glass. The eye-

sight of aged persons, or those who have a defective sight, receives relief from spectacles, which they must have sought in vain, without this invention. They were the fortunate discovery of a monk of Pisa, in the year 1299. Nor does it only serve for useful purposes: it also supplies us with various kinds of ornaments. Most of the precious stones are so well imitated by this composition, as to deceive the eye of those who are not critical judges.

*CHARLES.* Among the variety you have enumerated, you have omitted burning glasses, which are so contrived, that they draw the sun's rays into one point or focus, and are capable of setting fire to any thing that will burn. Some historians relate, that Archimedes, the celebrated mathematician of Syracuse, invented glasses of this kind, so powerful, that they set fire to the Roman ships, besieging Syracuse, under the command of Marcellus, and destroyed the whole fleet. Thus the ingenuity and invention of one man was able to resist and repel the united force of thousands, under the command of the most accomplished general of his age and country.

*MR. HARCOURT.* Your historical anecdote is very suitably introduced, and is an eminent instance of the superiority of wisdom over brutal strength.

*SOPHIA.* Has not the invention of the armonica some claim to be mentioned, before we dismiss this subject?

*MRS. HARCOURT.* I am not surpris'd it should be recollected by a lover of music; but Sophia, you must not raise curiosity without satisfying it; perhaps some of the company may not know what an armonica is.

*SOPHIA.* The armonica is a musical instrument, peculiar for the sweetness of its tones, and consists of glasses, of the shape of a globe, cut in half. The whole set is fixed upon a spindle, and then played upon by turning them round with a wet finger.

*MR. HARCOURT.* This method of producing musical sounds though first introduced among us by

Mr. Puckeridge of Ireland, has been long since practised in Germany: and the Persians have also a similar invention, by striking seven cups of porcelain, containing a certain quantity of water, with small sticks.

*CECILIA.* Among the other curiosities made of glass, give me leave to mention Rupert's drops, which are formed somewhat in the shape of a pear, of green glass, and though they will bear the heaviest stroke of a hammer without breaking, fly to pieces in a moment, if you break off the tip of the tail.

*HENRY.* Pray, of what did they make windows before there was any glass? I can think of nothing that would keep out the cold, and be clear at the same time.

*Mrs. HARCOURT.* Horn and oiled paper were the substitutes they were obliged to use. Glass windows were not known in England till 1180; and then were considered as a mark of great magnificence, suitable only to palaces, churches, &c. The Italians possessed this art first. The French learned it of them, and from thence it was brought into England. Venice for many years excelled all Europe in the fineness of its glasses: and in the thirteenth century, were the only people that had the secret of making crystal looking-glasses. The glass manufacture was first begun in England in 1557. Glass plates were made at Lambeth, in 1673, under the patronage of the Duke of Buckingham, who introduced this manufacture into England, with amazing success. So that in a century we have attained the art in a degree, that rivals even the Venetians; and are no longer obliged to be supplied with this article from foreign countries.

*AUGUSTA.* What beautiful painted windows I have sometimes observed in churches. There is one in Norwich cathedral, that is reckoned to be very finely painted, done by Mrs. Lloyd, who was the wife of one of the deans. Papa was acquainted with

her, and he says she added many other elegant accomplishments to her skill in painting on glass.

*Mrs. HARCOURT.* Remark how much better this lady's leisure was employed, than it would have been in idle dissipation, or slothful indolence; her works remain a testimony of her industry and taste, and will long preserve her name from oblivion. The ancient manner of painting on glass was very simple, and consisted in the mere arrangement of pieces of glass of different colours, in some sort of symmetry, and constituted a species of what we call mosaic work. In time, the taste for this kind of work improved, and the art being found applicable to the adorning of churches and other public buildings, they found means of incorporating the colours with the glass itself, by exposing them to a proper degree of fire, after the colours are laid on.

*Mr. HARCOURT.* There is an easy method of painting small pictures on glass, called back-painting, which requires but little skill, and produces a pretty effect. You must take a piece of crown glass, the size of the print you intend to paint, a mezzotinto is the best adapted to the purpose; soak your print in clean water for forty-eight hours, if it be on very strong, close, hard gummed paper; but if on a soft spongy paper, two hours will be sufficient; then lay the print between four sheets of paper, two beneath it, and two above it, that the moisture may be drawn out of it. In the mean while, let the glass be warmed at the fire, then with a hog's-hair brush dipped in melted Strasburg turpentine, smear the glass smoothly and evenly. Lay the print upon the glass, rubbing it gently from one end to the other, that it may lie close. With the finger rub off the paper from the backside of the print, till nothing can be seen, but the print, like a thin film upon the glass, and set it aside to dry. When it is well dried, varnish it over with some white transparent varnish, that the print may be seen through it, which is now fit for painting. Having prepared a variety of oil col-

ours, which must be ground very fine, and tempered very stiff, lay such colours on the transparent print as your fancy and taste direct; the outlines of the print guiding the pencil, and it will produce a very pretty effect. You must be careful to lay on the colours thick enough to appear plainly through the glass. When your grotto is finished, you may exercise yourselves this way, and each one produce a picture, though much inferior to those works that require the hand of an artist, yet affording amusement for a leisure hour, and varying the course of your occupations. Adieu, my dear children; I wish you repose and pleasant dreams.

CONVERSATION X.

*HENRY.* **M**AY I be allowed to chuse a subject for this evening. I want to know what sugar is made of. I heard Mr. Jenkins say it was a salt, and I think he must be mistaken, for I cannot taste the least flavour of salt in it.

*Mr. HARCOURT.* Chemically considered, he is in the right. Sugar is a sweet, agreeable, saline juice, expressed from many different kinds of vegetables. Carrots, parsnips, white and red beets yield sugar, but the plant, from which the sugar, that is generally used, is procured, is the sugar-cane; a sort of reed that grows in great plenty, in both the East and West-Indies. Sophia, endeavour to give us a botanical definition of it.

*SOPHIA.* It is a genus of the triandria digynia class. Its characters are, that it has no empalement; but instead of it, a woolly down longer than the flower that incloses it. The flower is bivalve, the valves are oblong, acute pointed, concave, and chafsy. It has three hairs like stamina, the ends of the valves terminated by oblong summits; and an awl-shaped germen, supporting two rough styles, crowned by single stigmas, the germen becomes an oblong,

acute pointed seed, invested by the valves. It is cultivated in both the Indies for its juice, which when boiled, affords that sweet salt which is called sugar.

*Mr. HARCOURT.* The canes grow from eight to twenty feet high, they are jointed, and at each joint are placed leaves. They are propagated by cuttings, which are generally taken from the tops of the canes, just below the leaves; a deep soil and light land are most suitable to the sugar plant, and the rainy season is the proper time for planting it. The ground should be marked out by a line, that the canes may be regularly disposed, and at equal distances. The common method of planting them, is to make a trench with a hoe, which is performed by the hand; into this trench a negro drops the number of cuttings intended to be planted, which are planted by other negroes, who follow him: and the earth is drawn about the hills with a hoe.

*CHARLES.* I fancy agriculture is not so well understood in the Indies, as it is in Europe: or they would make use of the plough in these operations; as it would perform the work both more expeditiously, and in a completer manner, than can be done by the hand. What length of time, and what multitudes of hands, would it occupy, to hoe up all the land in England, that is to be sowed with corn every season!

*Mr. HARCOURT.* Horses are very scarce in the West-Indies especially, and almost all laborious operations are performed by the hands of negro slaves.

*AUGUSTA.* Are those countries inhabited by negroes? I understood that they were the natives of Africa.

*Mr. HARCOURT.* You were rightly informed, my dear, they are indeed natives of Africa, but snatched from their own country, friends, and connections, by the hand of violence, and power. I am ashamed to confess that many ships are annually sent from different parts of England, particularly Bristol and Liverpool, to the coast of Guinea, to procure slaves.



from that unhappy country, for the use of our West-India islands, where they are sold to the planters of sugar-plantations, in an open market like cattle, and afterwards employed in the most laborious and servile occupations, and pass the rest of their lives in an involuntary and wretched slavery.

*SOPHIA.* How much my heart feels for them! How terrible must it be, to be separated from one's near relations! Parents perhaps divided from their children for ever; husbands from their wives; brothers and sisters obliged to take an eternal farewell. Why do the kings of the African states suffer their subjects to be so cruelly treated?

*Mrs. HARCOURT.* Many causes have operated to induce the African princes to become assistants in this infamous traffic, and instead of being the defenders of their harmless people, they have frequently betrayed them to their cruellest enemies. The Europeans have found the means of corrupting these ignorant rulers, with bribes of rum, and other spirituous liquors, of which they are immoderately fond. At other times they have fomented jealousies, and excited wars between them, merely for the sake of obtaining the prisoners of war for slaves. Frequently they use no ceremony, but go on shore in the night, set fire to a neighbouring village, and seize upon all the unhappy victims, who run out to escape the flames.

*CECILIA.* What hardened hearts must the Captains of those ships have! They must have become extremely cruel, before they would undertake such an employment.

*Mrs. HARCOURT.* It is much to be feared that most of them, by the habits of such a life, are become deaf to the voice of pity; but we must compassionate the situation of those, whose parents have early bred them to this profession, before they were of an age to chuse a different employment. But to resume the subject of the negroes. What I have related is only the beginning of their sorrows. When

they are put on board the ships, they are crowded together in the hold, where many of them mostly die from want of air and room. There have been frequent instances of their throwing themselves into the sea, when they could find an opportunity, and seeking a refuge from their misfortunes in death. As soon as they arrive in the West-Indies, they are carried to a public market, where they are sold to the best bidder, like horses at our fairs. Their future lot depends much upon the disposition of the master, into whose hands they happen to fall, for among the overseers of sugar-plantations there are some men of feeling and humanity; but too generally their treatment is very severe. Accustomed to an inactive indolent life, in the luxurious and plentiful country of Africa, they find great hardship from the transition, to a life of severe labour, without any mixture of indulgence to soften it. Deprived of hope of amending their condition, by any course of conduct they can pursue, they frequently abandon themselves to despair, and die, in what is called the seasoning, which is becoming inured by length of time to their situation. Those who have less sensibility and stronger constitutions, survive their complicated misery but a few years: for it is generally acknowledged that they seldom attain the full period of human life.

*AUGUSTA.* Humanity shudders at your account; but I have heard a gentleman, that had lived many years abroad, say, that negroes were not much superior to the brutes, and that they were so stupid and stubborn, that nothing but stripes and severity could have any influence over them.

*Mr. HARCOURT.* That gentleman was most probably interested in misleading those with whom he conversed. People, who argue in that manner, do not consider the disadvantages the poor negroes suffer from want of cultivation. Leading an ignorant savage life in their own country, they can have acquired no previous information; and when they fall

into the hands of their cruel oppressors, a life of laborious servitude, which scarcely affords them sufficient time for sleep, deprives them of every opportunity of improving their minds. There is no reason to suppose that they differ from us in any thing but colour, which distinction arises from the intense heat of their climate. There have been instances of a few, whose situation has been favourable to improvement, that have shewn no inferiority of capacity : and those masters, who neglect the religious and moral instruction of their slaves, add a heavy load of guilt to that already incurred, by their share in this unjust and inhuman traffic.

*CHARLES.* My indignation arises at this recital. Why does not the British parliament exert its power to avenge the wrongs of these oppressed Africans ? what can prevent an act being passed to forbid Englishmen from buying and selling slaves ?

*Mr. HARCOURT.* Mr. Wilberforce, a man that does honour to humanity, has made several fruitless efforts to obtain an act for the abolition of this trade. Men, interested in its continuance, have hitherto frustrated his noble design ; but we may rely upon the goodness of that Divine Providence, that careth for all creatures, that the day will come, that their rights will be considered, and there is great reason to hope, from the light already cast upon the subject, that the rising generation will prefer justice and mercy, to interest and policy : and will free themselves from the odium we at present suffer, of treating our fellow-creatures in a manner unworthy of them, and of ourselves.

*Mrs. HARCOURT.* Henry, repeat that beautiful apostrophe to a negro woman, which you learned the other day out of Mrs. Barbauld's Hymns.

*HENRY.* " Negro woman, who sittest pining in captivity, and weepest over thy sick child, though no one seeth thee, God seeth thee, though no one pitieth thee, God pitieth thee. Raise thy voice forlorn, and abandoned one ; call upon him from amidst thy bonds, for assuredly he will hear thee."

*CECILIA.* I think no riches could tempt me to have any share in the slave-trade. I could never enjoy peace of mind, whilst I thought I contributed to the woes of my fellow-creatures.

*Mr. HARCOURT.* But Cecilia, to put your compassion to the proof, are you willing to debar yourself of the many indulgencies that we enjoy, that are the fruit of their labour? sugar, coffee, rice, calico, rum, and many other things, are procured by the sweat of their brow.

*CECILIA.* I would forego any indulgence to alleviate their sufferings.

*The rest of the Children together.* We are all of the same mind.

*Mrs. HARCOURT.* I admire the sensibility of your uncorrupted hearts, my dear children. It is the voice of nature and virtue. Listen to it on all occasions, and bring it home to your bosoms, and your daily practice. The same principle of benevolence, which excites your just indignation at the oppression of the negroes, will lead you to be gentle towards your inferiors, kind and obliging to your equals, and in a particular manner condescending and considerate towards your domestics; requiring no more of them, than you would be willing to perform in their situation; instructing them when you have opportunity; sympathizing in their afflictions, and promoting their best interests when in your power.

*AUGUSTA.* My governess forbids me ever to speak to the servants, therefore I cannot shew them any kindness, without disobeying her.

*Mrs. HARCOURT.* Your governess shews her discretion in forbidding you to be familiar with the servants. Their want of education renders them improper companions, but can never deprive them of their claim to our tenderness and good offices.

*Mr. HARCOURT.* It is time to proceed in our account of the process of preparing the juice of the sugar-cane for use. When the canes are ripe, they are cut, and carried in bundles to the mill. The mills

consist of three wooden rollers, covered with steel-plates, and are set in motion, either by water, wind, cattle, or even the hands of slaves. The juice being squeezed out of the canes, by the rollers, runs through a little canal into the sugar-house, where it falls into a vessel, from whence it is conveyed into the first copper. With the liquor is mixed a quantity of ashes and quick-lime, which serves to purify it, by raising up the unctuous matter in form of a scum to the top, which is skimmed off and given to poultry. This operation is performed five or six times, till the sugar is sufficiently purified, and become of a proper thickness to be converted into the various kinds for use. It is then put into hogsheds, and sent over to England to the care of the sugar-refiners, whose business it is to complete the process, by boiling it up with bullocks blood, in order to clear it. Sometimes whites of eggs are used for the same purpose. They add a little of the finest indigo to give it a good colour. It is boiled over again, that the moist parts may evaporate. The next thing to be done is to fill the moulds, which are in the form of inverted cones. The rooms in which these moulds are placed are heated to a suitable degree, to dry the sugar they contain. When the loaves are fully dried, they are papered, and sold to the grocer.

*HENRY.* Are sugar-candy and barley-sugar made from the sugar-cane? they are different from sugar both in taste and colour.

*Mr. HARCOURT.* The material is the same, although the preparation varies. Sugar-candy is sugar crystallized. It is first dissolved in a weak lime-water, then clarified, scummed, strained through a cloth, and boiled. It is afterwards put into forms or moulds, that are crossed with threads to retain the sugar as it crystallizes. These forms are suspended in a hot stove, which is shut up, and the fire made very vehement. Upon this, the sugar fastens to the strings that cross the forms, and there hangs in little splinters of crystal. When the sugar is quite dry,

the forms are broken, and the sugar is taken out candied. Red sugar-candy is coloured, by pouring a little juice of the Indian fig into the vessel, whilst the sugar is boiling. Barley-sugar, is sugar boiled till it is brittle, and then poured on a stone anointed with oil of sweet almonds, and formed into twisted sticks. It should be boiled up with a decoction of barley, whence it takes its name; they sometimes cast saffron into it, to give to it the bright amber colour.

*Mrs. HARCOURT.* Sugar is a very useful commodity. It preserves both animal and vegetable substances from putrefaction; and we are indebted to it, on this account, for all the variety of conserves and sweetmeats which adorn and enrich our repasts. White sugar-candy is used by miniature painters to prevent the colours from cracking, when mixed with gum-arabic; and Henry need not be told how useful barley-sugar is in coughs and hoarsenesses.

*Mr. HARCOURT.* It is supposed that, although the ancients were acquainted with this plant, they were ignorant of our method of refining and preparing it. The first account we have of sugar refiners in England, is in the year 1659. Several other things are produced from the sugar-cane. Treacle is the syrup that runs from the barrels of raw sugar. Rum is distilled from the sugar-cane.

*CHARLES.* Is not arrack also made from sugar?

*Mr. HARCOURT.* It is sometimes distilled from rice and sugar, fermented with the juice of cocoa-nuts; but it is generally distilled from a vegetable juice called toddy, which flows by incision, out of the cocoa-nut tree, like the birch juice procured among us for wine. The sugar-house of a refiner is a large building, consisting of six or seven floors, and the utensils necessary to perform the different operations, require the aid of various kinds of workmen. The pans, coolers, cisterns, syrup-pipes, basons, ladles, skimmers, and sometimes the candy-pots are made of copper. Pipes, pumps, and cisterns made of lead

are also used. The iron-founder supplies bars of a triangular form to be laid under the pans; also the cockel, which is an iron trunk used to dry the goods in the stove; iron doors, &c. The carpenter is required to furnish racks, troughs, stools, blocks, coolers, oars, &c. Tubs and backs to hold the lime-water, which contain from thirty to two hundred barrels, employ the back-maker. The wicker-work consists of refining-baskets, scum-baskets, pulling-up baskets, coal and clay-baskets, &c. Thus, if we consider the numbers employed in building the ships used in bringing over the sugar, and in conveying the poor slaves from their own country; planters, overseers, &c. we may suppose that we do not taste a lump of sugar that is not produced by the united labour of a thousand hands.

*SOPHIA.* And yet we use the conveniences of life in a careless wasteful manner, without reflecting one moment on the trouble necessary to procure them. May I relate the manner of obtaining the maple-sugar, which some have endeavoured to introduce in the room of the produce of the sugar-cane.

*Mrs. HARCOURT.* By all means it will give us pleasure to hear it.

*SOPHIA.* The acer saccharinum, or the sugar-maple-tree, grows in great quantities in the western countries of all the middle states of the American Union. These trees are generally found mixed with the beech, hemlock, white and water-ash, the cucumber-tree, linden, aspen, butter-nut, and wild cherry-trees. They grow only on the richest soils, and frequently in stony ground. Springs of the purest water abound in their neighbourhood. They are, when fully grown, as tall as the white and black oaks, and from two to three feet in diameter. They put forth a beautiful white blossom in the spring before they shew a single leaf. The wood of the maple-tree is extremely inflammable. Its small branches are so much impregnated with sugar, as to afford support to the cattle, horses, and sheep of the first

settlers, during the winter, before they are able to cultivate forage for that purpose. Its ashes afford a great quantity of pot-ash, exceeded by a few of the trees that grow in the woods of the United States. The tree is supposed to arrive at its full growth in twenty years. It is not injured by tapping; on the contrary, the oftener it is tapped, the more syrup it yields. The effects of a yearly discharge of sap from the tree, in improving and increasing the sap, are demonstrated from the superior excellence of those trees, which have been perforated in an hundred places, by a small wood-pecker, which feeds upon the sap. The method of obtaining the sap, is by boring a hole in the tree, with an auger; a spout is introduced about half an inch into the hole, made by the auger. The sap flows from four to six weeks, according to the temperature of the weather. Troughs are placed under the spout to receive the sap, which is carried every day to a large receiver, whence it is conveyed, after being strained, to the boiler. There are three modes of reducing the sap to sugar; by evaporation, by freezing, and by boiling, of which the latter is most expeditious. The profit of this tree is not confined to its sugar. It affords a most agreeable molasses, and an excellent vinegar. The sap, which is suitable for these purposes, is obtained, after the sap which affords the sugar has ceased to flow, so that the manufactories of these different products of the maple-tree, by succeeding, do not interfere with each other. The molasses may be used to compose the basis of a pleasant summer beer. The sap of the maple is moreover capable of affording a spirit. A tree so various in its uses, if duly cultivated, may one day supply us with sugar; and silence the arguments of the planters, for a continuance of the slave trade.

*Mr. HARCOURT.* Very philosophically observed. We thank you for your entertaining account, and wish you good-night, as it is already past the usual time of separation.



CONVERSATION XI.

*CECILIA.* I THANK you, dear mamma, in the name of my brothers and sister, for the pleasure you have given us, in allowing us to accept Farmer Dobson's invitation to his sheep-shearing. We have passed a very agreeable afternoon, both from the civility of the honest farmer and his wife, and the novelty of the scene, which was very striking to us, as we had never seen any thing of the kind before. It reminded me of Thomson's description of a sheep-shearing, which with your leave I will repeat.

*Mrs. HARCOURT.* It will give me pleasure to hear it, provided you are careful to speak slow, distinct, and give every word its proper emphasis.

*CECILIA.*

“ In one diffusive band,  
 They drive the troubled flocks, by many a dog  
 Compell'd, to where the mazy running brook  
 Forms a deep pool ; this bank abrupt and high,  
 And that fair-spreading in a pebbled shore,  
 Urg'd to the giddy brink, much is the toil,  
 The clamour much, of men, and boys, and dogs,  
 Ere the soft fearful people to the flood  
 Commit their woolly fides. And oft the swain,  
 On some impatient seizing, hurls them in :  
 Emboldened then, nor hesitating more,  
 Fast, fast, they plunge amid the flashing wave,  
 And, panting, labour to the farthest shore.  
 Repeated this, till deep the well-washed fleece  
 Has drunk the flood, and from his lively haunt  
 The trout is banish'd by the sordid stream ;  
 Heavy, and dripping, to the breezy brow  
 Slow move the harmless race : where, as they spread  
 Their swelling treasures to the sunny ray,  
 Inly disturb'd, and wondering what this wild  
 Outrageous tumult means, their loud complaints  
 The country fill ; and, toss'd from rock to rock,

H

Incessant bleatings run around the hills.  
 At last, of snowy white, the gathered flocks  
 Are in the wattled pen innumerable press'd,  
 Head above head ; and rang'd in lusty rows,  
 The shepherds sit, and whet the sounding shears.  
 The housewife waits to roll her fleecy stores,  
 With all her gay-dressed maids attending round.  
 One, chief, in gracious dignity enthron'd,  
 Shines o'er the rest, the pastoral queen, and rays  
 Her smiles, sweet beaming, on her shepherd king ;  
 While the glad circle round them yield their souls  
 To festive mirth, and wit that knows no gall.  
 Meantime, their joyous task goes on apace :  
 Some mingling stir the melted tar ; and some,  
 Deep on the new shorn vagrant's heaving side  
 To stamp his master's cypher ready stand ;  
 Others th' unwilling wether drag along ;  
 And, glorying in his might, the sturdy boy  
 Holds by the twisted horns th' indignant ram.  
 Behold, where bound, and of its robe bereft,  
 By needy man, that all-depending lord,  
 How meek, how patient, the mild creature lies !  
 What softness in its melancholy face,  
 What dumb complaining innocence appears !  
 Fear not, ye gentle tribes, 'tis not the knife  
 Of horrid slaughter that is o'er you wav'd,  
 No, 'tis the tender swain's well-guided shears,  
 Who having now, to pay his annual care,  
 Borrow'd your fleece, to you a cumbrous load,  
 Will send you bounding to your hills again.

*Mrs. HARCOURT.* Tolerably well repeated ; a  
 general acquaintance with the best English poets,  
 united with a retentive memory and graceful enun-  
 ciation, will furnish the rare and delightful accom-  
 plishment of repeating selected passages, which may  
 supply an elegant amusement for the vacant hour of  
 domestic leisure, and prevent that lassitude so fre-  
 quently complained of at home, and which compels  
 so many to seek a refuge from themselves in dissi-  
 pation and fashionable pleasure.

*SOPHIA.* My time is so variously filled up, that I never experience that wearisomeness.

*Mrs. HARCOURT.* A well chosen succession of employments, is the best antidote against *ennui*, as it is termed by the French, or listlessness. Reading, drawing, natural history in its different branches, simple mathematics, experimental philosophy, with various other rational pursuits, are admirably calculated to fill up the leisure hours of persons in easy circumstances, whose duties or business afford them opportunity for such studies.

*Mr. HARCOURT.* It is a just observation, that none but the idle want employment. The active mind collects amusement from the most trifling events. Cannot a sheep-shearing supply us with a hint for the subject of our present conversation? *Sophia*, endeavour to entertain us with the natural history of the sheep.

*SOPHIA.* Sheep, according to Linnæus, are of the order of pecora, and make a distinct genus, the characters which distinguish them, are that their horns are hollow, bent backward, wreathed, crooked, and scabrous. They have eight cutting teeth in the lower jaw, but none in the upper, and no canine teeth. The wool of these animals consists only of long slender hairs, much twisted, and variously interwoven with one another. This cloathing is peculiar to the sheep kind, so far as is yet known, no other animal having been discovered with a similar covering; neither is it possessed by all the species of sheep, some of those of the distant nations have short hair like that of the goat.

*Mr. HARCOURT.* In addition to your general account of the sheep, I will enumerate the species, and their peculiarities, which according to the same great master of natural arrangement, Linnæus, are three; first the *ovis aris*, or ram sheep, which comprehends many varieties, such as the common sheep, with large horns twisting spirally and outwardly: the hornless sheep, with the tail hanging down to the

knees; this kind is common in many parts of England. The Spanish, or many horned sheep, having usually three horns, and sometimes four or five. This sort of sheep is frequent in Iceland, Siberia, and other northern countries. The African sheep, which has short hair like that of the goat; and the broad-tailed sheep, which is common in Syria, Barbary, and Ethiopia. The tails of these are so long, as to trail upon the ground, and the shepherds are obliged to put boards with small wheels under them, to keep them from galling. These tails are esteemed a great delicacy, being of a substance between fat and marrow; they sometimes weigh fifty pounds each. The broad-tailed sheep are also found in the kingdom of Thibet, and their fleeces are equal to those of Caramania in fineness, beauty, and length. The Cackemirians engross this article, and have factors in all parts of Thibet, for buying up the wool, which they work up into those elegant shawls, that are brought into this country from the East-Indies, and this manufacture supplies them with a considerable source of wealth. The second species is the *ovis Guiniensis*, commonly called the Angola sheep. They are long legged and tall, and their ears hang down, the horns are small and bending down to the eyes. The neck is adorned with a long mane, the hair of the rest of the body is short, and it has wattles on the neck. The third species is the *ovis strepsiceros*, or Cretan sheep, with horns quite erect, twisted like a screw, and beautifully furrowed on the outside. This kind is common in Hungary, and large flocks of them are found on Mount Ida, in Crete. The manners of this animal are naturally harmless and timid; it threatens by stamping with its foot, but its only resistance is by butting with its horns. It generally brings one young one at a time, sometimes two, and rarely three. It is a valuable animal to the farmer, as it is kept at the least expence of any, and will thrive upon almost any pasture ground, not particularly wet; a constant damp causes them to rot.

*Mrs. HARCOURT.* Almost every part of it is applied to some useful purpose. The flesh is a delicate and wholesome food. The skin, when dressed, forms different parts of our apparel, as shoes and gloves; it is also used for covers of books. The entrails, properly prepared and twisted, are used in clocks, and various musical instruments. The bones calcined, form materials for tests for the refiner. The milk is thicker than that of cows, and consequently yields a greater quantity, in proportion, of butter and cheese: and even the dung is useful as a rich manure; but the most valuable part of all is the fleece, or wool, which when washed, thorn, dressed, combed, spun, and wove, makes a vast variety of stuffs and cloths, suitable both for cloathing and furniture, and was so highly valued by the ancients for its utility, as to have given rise to the story of the golden fleece, which I request the favour of Charles to relate.

*CHARLES.* The ancients, always fond of fables, concealed the simplest events, under the appearance of some extraordinary story. Jason, son of Æson, king of Theffaly, sailed in the first large ship (called Argo) to fetch the golden fleece from Colchis. Fifty-four brave Theffalians accompanied him in his expedition, and from the name of the vessel are called Argonauts. Their object is supposed to have been the establishment of a profitable trade in wool, in which that country excelled. The difficulties he met with in his undertaking, and which he overcame by his prudence, are represented by the fable of a dragon, that guarded the fleece, and which he is said to have killed by the assistance of Medea, an enchantress. The education this prince had received from Chiron, the centaur, famous for his arts and learning, had fitted him for cultivating commerce, and promoting useful discoveries. Jason at length reigned, and died peaceably at Colchis.

*SOPHIA.* Another proof of the high veneration that was paid to the inventors of the woollen manu-

facture, is that the art of preparing it was attributed to Minerva, the goddess of wisdom, and the protectress of the useful arts.

*CECILIA.* We have been entertained with the history of the sheep, and a general account of its uses; but I am very desirous of knowing the manner of working wool, and rendering so rough a material fit for the purposes of spinning and weaving fine cloth.

*Mrs. HARCOURT.* Various are the operations it undergoes before it is in a proper state for the purposes you mention. The fleeces, when taken out of the bales in which they are packed, after shearing, must be scoured; when the wool has continued long enough in the liquor to dissolve and loosen the grease, it is taken out, and well washed and dried; it is then beat with rods, on hurdles of wood, to clear it of the dust and grosser filth. The next thing is to pick it, and oil it with oil of olives. It is now given out to the spinners, who first card it on the knee; that is, pass it between the points or teeth of two instruments something like a curry-comb, called cards, to disentangle it, and prepare it for spinning, which is an operation too common to need description. The thread or worsted being spun, reeled, and made into skeins, is ready for the hand of the weaver, who begins his work by putting the warp, or threads, the long way of the piece, into the loom, which he stiffens with size before he forms the woof, which is done by throwing the thread with a shuttle across the warp, till the work be finished; when it is to be cleared of all knots, &c. and carried to the fuller to be scoured and cleansed, ready for dying; after it is dyed, it is pressed and prepared for sale. Different kinds of goods require variation in the process, according to the kind of stuff intended to be made.

*AUGUSTA.* Wool is applied to a vast many different purposes; what are the principal manufactures in which it is employed?

*Mr. HARCOURT.* Let Henry endeavour to enu-

merate the things that we use, that are made of wool.

*HENRY.* Broad cloths for men's coats, flannel, blankets, carpets, rugs, caps, stockings, and various kinds of stuffs.

*CECILIA.* All stockings are not knitted, how are the others made?

*Mr. HARCOURT.* They are wove in a machine, called a stocking-frame, very ingeniously contrived, but too complex to give you any idea of it by description. Wool is the staple commodity of this island, and forms the principal article in our foreign and domestic trade. The yearly produce of wool in England, towards the close of the last century, was calculated at two millions sterling, and consequently it gives employment to a vast number of hands. A pack, or two hundred and forty pounds weight of short wool, is computed to employ sixty-three persons a week, to manufacture it into cloths: and when it is made into stuffs or stockings, it employs a much greater number.

*CHARLES.* The working of wool is doubtless an invention of great antiquity; but how long has it been introduced into England?

*Mr. HARCOURT.* It may be said to have risen into notice about the fourteenth century. King Edward the third introduced the fine woollen manufacture from the Netherlands. Queen Elizabeth greatly improved the state of this manufacture by her patronage, in which she received considerable assistance from the troubles in the Low Countries, excited by the severity of the Duke of Alva, and the Spanish inquisition, on account of religion, which drove numbers of manufacturers to take shelter in England, where they enjoyed protection and encouragement to settle. Contrast the conduct of Elizabeth and the Duke of Alva. The one cherished the useful arts, and diffused happiness and wealth among her people; the other, from a gloomy superstition, deprived his country of useful manufact-

urers, and obliged them to take refuge in the dominions of his rival, which they enriched by their labours and skill.

*Mrs. HARCOURT.* Nature is an excellent instructor. From the nautilus men learned the art of sailing. From the spider they are supposed to have been taught the art of weaving. Attention to natural objects will probably supply new discoveries, which are now unthought of.

*CHARLES.* What country produces the finest wool?

*Mr. HARCOURT.* The wool of Asia excels that of Europe. Of the European, none is more valued than the Spanish and the English. Spain is famous for its breed of sheep, they have frequently ten thousand in a flock, under the care of fifty shepherds, who are subservient to the authority of one man.

*HENRY.* I think I should like to be a shepherd, it must be an easy pleasant life.

*Mrs. HARCOURT.* They generally pass their time in a very indolent useless manner; though some in the north of England knit stockings, yet it appears to me, that a better plan of employment might be suggested for them, without interfering with their principal occupation. Those who could read and write, might keep a register of the weather, and make observations upon the natural objects that presented themselves to their view, which might be a means of promoting useful knowledge.

*CHARLES.* Is it not the custom for the lord chancellor, the judges, and masters in chancery, to be seated on woofsacks, in the house of Lords?

*Mr. HARCOURT.* That is a custom not very easy to be accounted for, unless it is to remind them of protecting and maintaining the woollen manufactures of this country.

*Mrs. HARCOURT.* It is time to put an end to our conversation. Supper is ready. Good night, children.



## CONVERSATION XII.

*Mrs. HARCOURT.* AS the woollen manufacture seemed to afford us great entertainment the last time we met, may we not be amused with the particulars of the linen and cotton manufactures in their various branches? Sophia has made herself acquainted with the natural definitions of both flax and hemp, with the design of contributing materials for our conversation.

*Mr. HARCOURT.* We cannot adopt a more suitable subject; the one leads the way to the other. In the early savage state, when men united in small societies, for the sake of protection and defence, we find they clothed themselves with the skins of beasts in their rough natural state, unimproved by any art or dressing, merely for the purposes of decency and warmth. In cold climates, the savage tribes frequently wear the hair inwards. As they advance to a higher state of civilization, they make use of materials that admit of greater skill in preparing, and study ornament as well as use. Captain Cook relates, that the inhabitants of some places he visited, have a method of weaving cloth of a certain species of grass. The natives of Atooi make cloaks and caps of feathers, with great ingenuity, on which they set a high value, and which appear appropriated to the chiefs, and great men of the country. Many of the islands in the South-Sea, are so far advanced towards civilized life, as to have an established manufacture of cloth, which is made by the women. They take the stalks or trunks of the paper-mulberry, which rarely grows more than seven feet in height, and about the thickness of four fingers. From these stalks they strip the bark, and scrape off the exterior rind; after which the bark is rolled up, and softened for some time in water; it is then beaten with a square instrument of wood, full of coarse grooves, but sometimes with a plain one. When suf-

ficiently beaten, it is spread out to dry ; the piece being from four to six or seven feet in length, and about half as broad. These pieces are joined by smearing part of them with the glutinous juice of a berry, called Tooo ; and, after being thus lengthened, they are placed over a large piece of wood, with a sort of stamp, composed of a fibrous substance laid beneath them. The manufacturers then take a bit of cloth, and having dipped it in a juice expressed from the bark of a tree, called kokka, rub it briskly over the piece that is making. This leaves a dry gloss, and a dull brown colour upon the surface, and the stamp makes, at the same time, a slight impression, which finishes the work. But when we compare these simple works, with the variety, elegance, and utility of the manufactures of the polished nations of Europe and Asia, the degrees of refinement and civilization are clearly marked ; and we are enabled to form distinct ideas of the difference between the rude productions of the untutored mind, and those which are the result of science and art ; but I am wandering from our subject. Sophia, your young friends wait impatiently to hear your account of flax and hemp, which form the materials of the linen of this country, from the coarsest cloth, to the finest lace.

*SOPHIA.* Flax is a genus of the petandria, pentagynia class. The flower has a permanent empalement, composed of five small spear-shaped acute leaves, five large oblong petals, and five awl-shaped erect stamina, terminated by arrow-shaped summits. In the centre is situated an oval germen, supporting five slender styles, crowned by reflex stigmas, which turn to a globular capsule with ten cells, opening with five valves, in each cell is lodged one oval, smooth seed, with an acute point. There are fourteen species. The common flax is an annual plant, that will grow in any kind of good sound land. The best land yields the best flax.

*CHARLES.* As the tilling and ordering of flax is so

profitable to the farmer, I regret it is not more frequently cultivated.

*Mr. HARCOURT.* Since you seem to be acquainted with the management of it; pray tell us the seasons for sowing and gathering it.

*CHARLES.* The time of sowing is the latter end of March. The best way of sowing flax seed is to drill it in equi-distant rows, about ten inches from one another. Towards the end of August the flax will begin to ripen, and must be pulled as soon as the seed grows brown, and bends down the heads.

*Mr. HARCOURT.* Riga supplies us with the best seed. Scotland and Ireland import great quantities from thence annually. Flax and hemp have the remarkable property of communicating a poisonous quality to water, when laid in it for the purpose of decaying the stem, and procuring the bark for mechanical purposes, so that cattle die that drink of it.

*AUGUSTA.* I am quite unacquainted with the manner of making linen from a plant. Mr. Harcourt said just now, that hemp and flax formed the materials of linen. I thought linen had been made of thread.

*CECILIA.* So it is; but all the various sorts of thread we use are made of flax.

*Mrs. HARCOURT.* Hemp is very similar to flax in its culture and use, therefore one description of the manner of preparing them will be sufficient for both. When they gather it, they pull it up by the roots, after which they bind it up in bundles. They comb out the heads on the teeth of a ripple, which pulls off the leaves, the husks of the seeds, and the seeds themselves together. These are gathered in a heap, and left in that condition for a few days, in order to heat a little, after which they are spread out to dry, before they are threshed, and the seeds are separated by winnowing and sifting. Then, in order to rot the bark, they are laid in water, that it may be more easily separated from the reed. When it is sufficiently rotted, the stalks are dried in an oven or kiln. The

next thing to be done is peeling off the bark, which is performed by various means, but it is most expeditiously effected by mills.

*HENRY.* Do not people beat hemp in Bridewell?

*Mr. HARCOURT.* The beating hemp with beetles is a very laborious employment, and is used as a punishment for the idle and dissolute, who are confined there for small crimes.

*Mrs. HARCOURT.* In order to complete the process, they beat it till it is soft and pliable, and, after washing and bleaching, it is heckled with instruments resembling a wool-dresser's comb, to disentangle the shorter tow from the longer, which is then fit to be spun into thread, for the different purposes of weaving, &c.

*AUGUSTA.* I am ashamed of my ignorance; but it is wonderful to me, to think that this piece of linen ever grew in a field.

*Mr. HARCOURT.* It is said that the first step to knowledge, is a consciousness of ignorance. Endeavour, children, to increase your stock of useful knowledge daily, by attention to every thing you see and hear. There are various kinds of linen, the principal materials of which are flax, cotton, and hemp. The linen trade of Europe is chiefly in the hands of the Russians, Germans, Flemings, Hollanders, French, and Irish. Cotton is a woolly or downy substance, which incloses the seed, and is contained in a brown husk or seed vessel of a certain plant that grows both in the East and West-Indies. There are several species of this plant cultivated in different places. Cotton forms a very considerable article of commerce; it is distinguished into two sorts; cotton in the wool, and spun cotton. The first is quilted between two stuffs, and is made use of for the purpose of rendering them thick and warm, as for coverlids for beds, petticoats, &c. but the latter kind is of most general use, as when spun and wove, it makes calicoes, cloths, muslins, dimities, besides a kind of quilting, ingeniously contrived to resemble

that done with a needle. It is also frequently intermixed with silk or flax, in the composition of various kinds of stuffs. Manchester, which has long been celebrated for various branches of the linen, silk, and cotton manufacture, is now conspicuous as the centre of the cotton trade.

*CHARLES.* Cotton anciently grew only in Egypt; and was confined to the use of the priests and sacrificers, for a singular kind of gown, worn by them alone.

*Mrs. HARCOURT.* Although hemp does not form a material for works of so delicate a texture as flax and cotton, it deserves to be noticed for the many useful properties it contains. Of what use would our ships be, without ropes and sails? Sophia, you have performed but half your promise; I call upon you now to fulfil the other part of your engagement.

*SOPHIA.* I am always ready to obey you. Hemp is a species of the dioecia pentandria class. It is male and female in different plants. The male flowers have a five-leaved concave empalement, without petals, but have five short hairy stamina, terminated by oblong square summits. The female flowers have permanent empalements of one leaf, without petals, but a small germen, which afterwards becomes a globular depressed seed, inclosed in the empalement. We have but one species of this plant, which is propagated in the rich fenny parts of Lincolnshire, in great quantities for its bark, which is useful for cordage, cloth, &c.

*CECILIA.* Oh, I remember, my uncle shewed me some, when I was on a visit at his house. It rises quick into a tall slender shrub, its stem is hollow; and he told me, was frequently made into charcoal, and is used in that form in the composition of gunpowder. Its leaves arise from the same pedicle, and are a little jagged; yielding a strong smell, apt to make one's head ache. The flowers grow in clusters, and the

bark is a tissue of fibres, joined together by a soft matter, which easily rots away.

*Mr. HARCOURT.* It does not appear that the ancients were acquainted with the use of hemp, with respect to the thread that it affords. The moderns are not contented with that production only, but torture this poor plant, for another valuable commodity that it contains; Henry can tell us what that is.

*HENRY.* Oil: I have not forgotten what I saw at the mill. They bruise the seed of flax, which is called linseed, as well as hempseed, with vast hammers, which are too heavy for men to lift; and are set a going with wheels, which are turned by the stream of a river.

*Mr. HARCOURT.* You shew a good memory. This oil has most of the qualities of the nut-oil, and is used as a substitute for it in painting. The oil drawn without the assistance of fire, is much esteemed in medicine, especially in the cure of catarrhs, coughs, asthmas, &c. After the oil is squeezed from the seeds, the seeds are heated over the fire, and being put into woollen bags, are pressed into pieces about twelve inches long, and six inches wide, called oil-cakes, and used to fatten cattle. These cakes, beaten again to dust, become an excellent manure for land. Thus ingenuity and industry have applied almost every part of this plant to a valuable purpose.

*CHARLES.* There is still one kind of linen cloth that we have not mentioned, and which I think more curious and extraordinary than any that has been described. If Augusta is surpris'd that linen should be spun from the fibres of plants, how much more astonish'd will she be, to find that cloth has been made of stone?

*AUGUSTA.* I am less inclined to disbelieve things that I do not understand, than I was, when first your kind mother permitted me to join in these instructive conversations; since I have heard many things equally new and wonderful to me, who had never been taught to observe or reflect upon the objects that

fell in my way ; but this time, Charles, I am really incredulous, and think you say this only to banter me.

*CHARLES.* Nothing is more certain. I have seen and handled specimens of it ; and to increase the wonder of my tale, this cloth will not consume in the fiercest fire.

*CECILIA.* Pray, Charles, explain it. This is an enigma that we cannot guess.

*CHARLES.* There is a mineral substance, called asbestos, of a whitish or silver colour, and a woolly texture, consisting of small threads or fibres, endued with the wonderful property of resisting fire, and remaining unconsumed in the intensest heat. A method has been found of working these fibres into cloth and paper. This kind of linen was much esteemed by the ancients, being held equally precious with the richest pearls. Pliny says, he had seen napkins made of it, which, when taken soiled from the table at a feast, were thrown into the fire, and were better scoured in that manner, than they could have been, if they had been washed in water ; but the purpose, for which it was so highly valued, was the making of shrouds for royal funerals, to wrap up the corpse, so that the ashes of the deceased might be preserved distinct from those of the wood, &c. of which the funeral pile was composed. They also made the wicks of their perpetual lamps of the same material.

*CECILIA.* Did not the ancients bury their dead in the same manner we do ?

*Mr. HARCOURT.* Different nations and ages have had various modes of disposing of their deceased friends and relations. The ancient Romans carried the body, borne on a bed or litter, covered with purple, and followed by the kindred of the deceased, to the rostra ; and if he had been a person of great quality, attended by old women, called *præficæ*, singing songs in his praise ; and the funeral was preceded by waxen images of all his predecessors borne on poles. When arrived there, the nearest of kin pronounced an oration extolling his virtues and those of his an-

cestors ; after which they proceeded to the funeral pile, whereupon they laid the body, and set fire to the whole. The ashes were then carefully gathered up, and inclosed in an urn, which was placed in the sepulchre or tomb. The ceremonies of the Egyptians were very peculiar. They embalmed the body with aromatic spices and perfumes, in order to preserve it from decay ; and it is supposed that the pyramids, so wonderful for their antiquity and magnitude, were erected as monuments or tombs to contain the bodies of their departed kings.

*Mrs. HARCOURT.* One of their customs pleases me much, as I think it was calculated to restrain vice, and encourage virtue. They brought their kings to a form of trial after their death : those who were convicted of having oppressed their people, and leading bad lives, were deprived of the honours of burial, and their memories held in detestation ; but every respect was paid to those who had passed their lives in a virtuous manner ; and even durable monuments erected to perpetuate their names, and transmit the recollection of their example to the latest posterity. To-morrow evening we shall select the silk manufacture as a subject, well suited to follow those of wool and linen, and forming a proper sequel to them. At present I find myself a little indisposed, and wish to retire early. Adieu, my dear children, easy dreams, and a good night to you.

### CONVERSATION XIII.

*Mrs. HARCOURT.* ACCORDING to our agreement yesterday, we shall pursue the manufacture of silk through its various operations this evening ; but as many of these are very similar to the same processes, in those of flax and hemp, we shall only just mention them, and dwell more on the manners and metamorphoses of the minute labourer, whose skill supplies the finest palaces



with their richest furniture, and without whose aid the habits of queens and princesses would be coarse and mean.

*Mr. HARCOURT.* Wool and flax are extremely valuable for their use, and are no more to be contemned in comparing them with silk, than iron is to be undervalued in comparison with gold and silver. The coarser metal, like the coarser materials for cloth or stuff, is far more necessary for our accommodation, though less brilliant and inferior for the purposes of ornament and splendour, than the more beautiful productions of the mine, or the silk-worm. Diamonds are dazzling to the eyes of the superficial observer, but was their real value subtracted from the adventitious price, that refinement and luxury have raised them to, we, like the cock in the fable, should prefer something more useful, and less shining.

*CHARLES.* I cannot help remarking, how sparing nature has been in those productions that are not of essential use, though highly prized, and sought with great avidity by the avarice of man.

*Mr. HARCOURT.* Nature, wise in all her ways, has bestowed the most useful things in the greatest abundance; and in many instances, has rendered those objects, which we are apt to despise for their minuteness and apparent insignificance; or because they are so common, that they do not call forth our attention, the most necessary to our subsistence and convenience.

*Mrs. HARCOURT.* The ancients were but little acquainted with the use and manufacture of the very soft, fine, bright, delicate thread, produced by the silk-worm. It was a very scarce commodity among them for many ages. The art of manufacturing it was first invented in the isle of Cos: and Pamphila, daughter of Platis, is honoured as the inventress.

*CHARLES.* It was not long unknown to the Romans, although it was so rare, that it was even sold weight for weight with gold. And I have read that the emperor Aurelian, who died in the year 275,

refused the empress, his wife, a suit of silk, which she solicited of him with much earnestness, merely on account of its dearness. Heliogabalus, the emperor, who died about half a century before Aurelian, is said to be the first person who wore a holosericum, or garment all of silk.

*Mr. HARCOURT.* The Greeks of Alexander the Great's army, are supposed to have brought wrought silk first from Persia, into Greece, about three hundred and twenty-three years before Christ. But the manufacture of it was confined to Phœnecia, from whence it was dispersed over the West. Two monks, coming from the Indies to Constantinople, in 555, under the patronage of the Emperor Justinian, brought with them great quantities of silk-worms; with instructions for the hatching their eggs, rearing and feeding the worms, and spinning and working the silk; which was the means of establishing manufactures at Athens, Thebes, and Corinth. The Venetians, soon after this time, commencing a commerce with the Greek empire, supplied all the western parts of Europe with silks for many centuries. But various improvements have been made in the art since that time; such as damasks, velvets, &c. The rest of Italy and Spain, by degrees, learned this art, from some manufactories established by Roger the Second, King of Sicily, about 1150, in different parts of his dominions. And a little before the reign of Francis the First, the French became masters of it.

*SOPHIA.* There was a company of silk women in England so early as the year 1455.

*Mrs. HARCOURT.* It is most probable that they were only employed in needle-work of silk and thread; for Italy supplied England with the broad manufacture, the chief part of the fifteenth century.

*Mr. HARCOURT.* Silk remained a rarity a long time in France. Their king, Henry the Second, is supposed to have worn the first pair of knit silk stockings. After the civil wars, the plantations of mul-

berry-trees were greatly encouraged by Henry the Fourth, surnamed the Great, on account of the love he shewed his people, and the true patriotifm he displayed during his troublesome reign. His successors continued to patronise the culture of these trees, and the produce of silk is at this day very considerable in that country. King James the First was very earnest to introduce it into England, but unhappily without effect. Although we have hitherto failed in rearing the worms, and raising raw silk of our own, the broad silk manufacture was introduced among us as early as the year 1620, and pursued with great vigour and advantage.

*Mrs. HARCOURT.* Greatly were we indebted to the tyranny and intolerance of our neighbours, the French, who by the revocation of the edict of Nantes, in 1685, which means the repealing a law made in favour of Protestants, drove vast numbers of their most skilful workmen in this branch, to take shelter in our land of liberty; they were kindly received, and settled in Spital-Fields, where they have carried on an ingenious and flourishing manufacture, till within these few years, that the British ladies have exchanged the wear of silk, for that of calicoes and muslins, by which transition these poor manufacturers are reduced to a very distressed situation; being without employment, and in want of most of the necessaries of life. It is an object worthy the consideration of persons of ability, to suggest some plan for turning the industry of so many hands into a different channel, and rendering them capable of maintaining their families, and becoming again useful to society. The silk-worm is an insect, not more remarkable for the precious matter it furnishes, than for the many forms it assumes. *Cecilia*, who keeps many of them, will amuse us with an account of these metamorphoses.

*CECILIA.* From an egg, about the size of a pin's head, it becomes a small black worm, which daily increases, till it is as large as a common caterpillar;

during its worm state, it frequently changes its skin, and becomes by degrees of a light ash colour, inclined to yellow, and almost transparent when about to spin. Henry brings me fresh mulberry leaves every morning to feed them with. When come to maturity, the silk-worm winds itself up in a silken bag or case, about the size and shape of a pigeon's egg; it forms this ball by moving its mouth backwards and forwards, chusing some corner to begin its work in, and fastening its silk, with a kind of natural gum, to the sides, till it has entirely inclosed itself; always working from one single end, which it never breaks, unless disturbed; and it is so fine, and so long, that I have read, that those who have examined it attentively, think they speak within compass, when they affirm, that each ball contains silk enough to reach the length of six English miles. On opening this curious web, one is surpris'd to find a chrysalis or aurelia, instead of a silk-worm, which is brown, and about the size of a bean. In this state it remains for some time apparently without life or motion; till at length out creeps a whitish moth, leaving the husk or outer skin of the chrysalis behind it. This is the last form it assumes; for, after having laid a multitude of eggs, it dies, and leaves them to be hatched by the warmth of the succeeding spring.

*Mrs. HARCOURT.* When the worm is supposed to have finished its work, which is generally in about ten days, the people who are employed in the care of these insects, for the sake of profit, collect the golden balls from off the mulberry trees, to the leaves of which they glue their silk, and putting a handful of them into a copper of warm water, of a proper temperature to dissolve the gum, and occasion the silk to wind off more readily, having first pulled off a woolly coarse kind of silk, which covers the balls. They take the ends of twelve or fourteen cones at a time, and wind them off into skeins. In order to prepare this beautiful material for the hand of the weaver, to be wrought into silks, stuffs, brocades,

fatias, velvets, ribbons, gauzes, &c. it is spun, reeled, milled, bleached, and dyed in a manner so similar to other materials, as to render a particular description unnecessary.

*Mr. HARCOURT.* There is a kind of silk, that we must not omit mentioning, which comes from the East-Indies, and is not the work of the silk-worm, but comes from a plant, that produces it in pods, much like those of the cotton-tree. The matter this pod contains is extremely white, fine, and moderately glossy. It spins easily, and is used in several manufactures of Indian and Chinese stuffs.

*SOPHIA.* I think I have heard of silk being spun from cobwebs.

*AUGUSTA.* Surely that would be impossible, the threads are so fine and slender; besides, who would be willing to breed and tend spiders. I am terrified at the sight of one. How frightful would it be to enter a room where thousands were confined! I shudder at the thought.

*Mrs. HARCOURT.* Had you not unfortunately been brought up with this prejudice, you would have had no more fear of a spider, than any other insect. In this country they are harmless, and have far more reason to dread us, than we have to be apprehensive of them. Use your reason, overcome such groundless fears; with men of sense, they lay our sex under the imputation of affectation or ignorance, and favour strongly of vulgarity, and want of education. When you have attentively considered the curious structure of this insect, and how wonderfully every part is adapted to its intended purpose, I believe you will be more inclined to look at it, in future, with an eye of admiration than terror.

*Mr. HARCOURT.* The secret has been discovered in France, within a few years, of procuring and preparing silk from spider's webs, and the using it in several manufactures has been attempted. Spiders are distinguished by naturalists into several kinds, according to the construction of their parts: but with

regard to the silk spiders, they are reduced to two kinds, those with long legs, and those with short, which last furnish the finest raw silk. The silk it makes is nearly as beautiful, glossy, and strong, as that of the silk-worm; the silk proceeds from five papilla or nipples, placed under the belly, towards the end of the tail. These serve as so many wire-drawing irons, to form and mould a viscous liquor, which, when dried in the air, as it is drawn through them, forms the silk. The threads are of two kinds; the first is weak, and only serves for that kind of web, with which they catch flies. The second is much stronger, and is applied to wrap up their eggs in, which by means of this inclosure, are sheltered from the cold, and the depredations of other insects. They wind these threads very loosely round the eggs, resembling the balls or bags of silk-worms, that have been prepared and loosened for the distaff. After having gathered twelve or thirteen ounces of these bags, M. Bon, the person who made these experiments, had them well beaten for some time, to get out all the dust; he then washed them in lukewarm water; after this he steeped them in a large vessel, with soap, salt-petre, and gum arabic; when he boiled the whole, for three hours, over a gentle fire; the soap was then washed out of them, and the bags dried, to fit them for carding. Stockings and gloves were made of it, and presented to the Academy in Paris, as well as to our Royal Society in London. The great difficulty that remains to be surmounted, is the art of breeding and confining these voracious insects in a room together, as the natural fierceness of spiders renders them incapable of living in community. Four or five thousand, being distributed into cells, the large ones soon killed and devoured the smaller, so that, in a short time, there was left scarcely more than one or two in a cell; and to this apparent unnatural propensity of eating one another, the scarcity of spiders is attributed, considering the vast number of eggs they lay. Every spider lays six

or seven hundred. The young ones live ten or twelve months without eating, and continue in their bags without growing, till the warmth of the returning summer, putting their viscid juices in motion, induces them to come forth, spin, and run about in search of food. But I believe Sophia is better qualified to give us a lecture on the construction and manners of this extraordinary little creature.

*SOPHIA.* With peculiar pleasure I shall relate what particulars I am acquainted with, as I am convinced, no one, who has examined its parts with a microscope, can behold it again as an object of abhorrence. Spider, a genus of the aptera order of insects; Linnæus enumerates forty-seven species. This insect affords, to the sagacious observer, a great many curious particulars. As the fly (which is the spider's natural prey) is an animal extremely cautious and nimble, and usually comes from above, it was necessary the spider should be furnished with a quick sight, and an ability of looking upwards, forwards, and sideways at the same time; and the microscope shews that the number, structure, and disposition of its eyes are wonderfully adapted to the serving all these purposes. Most spiders have eight eyes, two on the top of the head or body; for there is no division between them, the spider having no neck. These look directly upwards. There are two more in front, placed a little below these, and discovering all that passes forwards; and on each side, a couple more, one of which points sideways forwards, the other sideways backwards, so that it can see almost quite round. Whatever be the number of the spider's eyes, for there are not the same number in all the different species, they are, however, always immoveable and transparent, and are situated in a most curious manner. All spiders have eight legs, which they employ in walking, and two shorter ones, called arms, used in seizing their prey. All the legs are thickly beset with hairs, each has six joints, and ends with two hooked claws, which are jagged on

the inside. By means of this sort of teeth in the claws, they seize very fast hold of their prey; besides these weapons of attack, nature has furnished this creature with a pair of sharp crooked claws, or forceps, in the fore part of its head. These are placed horizontally or crosswise, and when not exerted for use, are concealed in two cases, contrived for their reception, in which they fold like a clasp knife, and there lie between two rows of teeth, which are likewise employed to hold fast the prey, so that a poor fly has not the least chance of escaping the jaws of such a well-armed formidable enemy.

*HENRY.* Pray, mamma, lend me your microscope, that I may examine every spider I find.

*Mrs. HARCOURT.* You are welcome to the use of it, provided you are careful not to break it. Mr. Lewenhoeck, who has made microscopic objects his peculiar study, has computed, that one hundred of the single threads of a full-grown spider, are not equal to the diameter of the hair of his beard; and consequently, if the threads and hair be both round, ten thousand such threads are not bigger than such a hair. He calculates that when young spiders first begin to spin, four hundred of their threads are not larger than one, which is of a full growth. Allowing this to be fairly stated, four millions of a young spider's threads are not so big as the single hair of a man's beard.

*AUGUSTA.* Astonishing minuteness! Since you say it is ridiculous, I will endeavour to overcome my aversion to spiders.

*Mrs. HARCOURT.* We are going from home for a few weeks; by the time we meet again, I flatter myself you will have availed yourself of my advice on many subjects; and that I shall find you improved by the exertion of your reason, in the correction of any foibles you may have. Your young friends will think the separation tedious; but you will enjoy each other's company the more for this little interruption. Adieu, my dear child, may you enjoy health and happiness till our next meeting.



## CONVERSATION XIV.

*Mrs. HARCOURT.* I PARTICIPATE the general pleasure at being again assembled, after so long an absence, to renew those pleasing and instructive conversations, in which we have passed so many agreeable evenings. During our separation, our time has not been spent idly; we have attentively examined the different objects we have met with on our journey; and each one of us has collected observations on some particular subject, in order to furnish materials for new entertainment. My dear Augusta, how have you amused yourself since we have been absent? have you added to your stock of knowledge by fresh acquisitions; or have you employed your time in perfecting yourself in those branches of science already begun?

*AUGUSTA.* No one has so much reason to rejoice at your return, my dear Mrs. Harcourt, as myself, I have indeed deeply lamented your absence; for without a guide, or a companion, what pleasure is there in pursuing improvement? Summer is a season that tempts one abroad. I have walked a great deal, and in some of my rambles have availed myself of your directions, to become acquainted with the nature of plants and flowers. I have learned the names of the different parts that compose them; and, if Sophia will give me her kind assistance, I hope in time to become a botanist.

*SOPHIA.* You cannot propose any thing more agreeable to me, than that we should pursue this delightful study together. Our walks will become more interesting, by having a particular object in view; every step we advance will supply new entertainment; from the humble moss, that creeps upon the thatch, to the stately oak, that adorns the forest.

*CHARLES.* Gently, Sophia; you must not intrude upon the subject I have chosen. The humble moss, and its diminutive companions, I willingly relin-

quish to your claims ; but the stately oak, and its attendant forest trees I have selected, as suitable to amuse this company with ; and though I readily resign any thing to you that merely concerns myself, I cannot give up the only theme that I am prepared to speak upon.

*SOPHIA.* Lay aside your apprehensions, brother ; I shall have too much pleasure in hearing you explain their properties and uses, to desire to interrupt you ; if my father has not provided any thing for this evening, may we not be favored with your observations ? I dare say we are all desirous of hearing them.

*MR. HARCOURT.* Charles has made so good a choice, that you cannot be more agreeably amused, than by attending to what he has collected on this subject. The beauty and utility of forest trees are so obvious and striking, that the most careless eye must be sensible of them. Charles, begin by telling us which are the principal trees used for timber.

*CHARLES.* Oak, elm, ash, beech, poplar, walnut, chestnut, fir, and service tree ; but they all yield to the oak, as well in beauty of foliage, as in the utility and duration of its timber. This noble tree forms our navies and cities ; and, should the cultivation of it be neglected, we may vainly deplore the loss of those wooden walls, that have so long been our pride and defence.

*HENRY.* I do not understand what you mean by that expression. I thought walls had always been built of brick or stone.

*CHARLES.* I ask pardon for making use of a figurative term. The naval strength of our island is frequently called its wooden walls, and consequently depends very much upon the cultivation of the best species of timber. Every part of the oak has its use ; the body is sawed into planks, to build ships and houses with ; shingles, pales, laths, cooper's work, and wainscot, are made of oak ; its wood is the most excellent for all works that require strength and duration. The bark is used by the tanner and dyer, to

whom the very saw-dust is useful. The ashes and lie are made use of for bucking of linen, and to cleanse and purify wine. The roots are suitable to make handles for daggers, knives, &c. Its fruit, the acorn, supplies food for deer and hogs; and when bruised, all kinds of poultry will thrive on it. Man, before the cultivation of corn, fed on acorns, and in times of scarcity, they may still prove a valuable substitute. Different parts of the oak are used in medicine; they are all of an astringent, binding quality. The wood of this tree is the least adapted to works that require to be glued together, as it will not easily adhere, either with its own kind or any other wood.

*CECILIA.* Is not ink made of oak galls? What part of the tree are they?

*CHARLES.* Yes, they are used in making ink, as well as in the composition of various medicines; neither the oak apples nor the galls are any part of the tree; they are formed by insects, which deposit their eggs in the stem or leaf. There are various kinds of galls, formed by different insects, the inhabitants of a great variety of trees and shrubs.

*Mrs. HARCOURT.* The history of galls is so curious, that I cannot resist relating some particulars concerning them. Among the smaller insects, there are many which, either in the whole state of the worm, or during some of the changes they undergo, are of so tender and delicate a structure, that they cannot bear the contact of air; and others that are continually exposed to the ravages of a number of destroyers. Provident nature, in order to their preservation, has allotted them the galls of trees and plants for an habitation; instinct directs them to make them for themselves; for they never find these excrescences ready formed. Some of these insects are produced from eggs, laid by their parent animal on the stalks of leaves, and as soon as they are hatched, make their way into the leaf or stalk, and find a safe lodging in this recess, and suitable food in its juices. Others are inserted by the mother fly, even in the egg state,

within the substance of the trees and branches. The parents of these are a peculiar race of flies, supplied with an instrument at the end of their tails adapted to this purpose.

*CECILIA.* How wonderful is the order of nature ! the formation of the smallest insect, did we but know the purpose of its different parts, would furnish us with subject of admiration.

*Mrs. HARCOURT.* The galls produced by different insects have a very different internal structure ; some of them have only one large cavity, in which a number of the animals live in community, others have several small cavities, with communications between each ; and others have different numbers of little cells each separate ; and finally, there are others in which there is only one cavity inhabited by one insect. The inhabitants of these two last kinds live in perfect solitude during the worm state, and can have no knowledge of any other living creature, till they have passed through the intermediate state of chrysalis, and become winged animals, like those to which they owed their origin, and are ready in their turn to lay their eggs, and provide for the security of their future offspring. The variations in the different kinds of galls are not confined to their structure merely ; each species has its peculiarity. Some of them are so hard, that they equal the hardness of the wood they grow upon ; and when cut open, appear composed of films much more densely and closely arranged than those of the wood itself ; others are soft and spongy, and resemble some of the tender fruits in appearance. The first kind are called gall-nuts, and the latter apple-galls, or berry-galls ; many of them are beautifully coloured, and are very useful to the dyer, as well as the physician. The kermes is the most valuable of them all, and produces a scarlet dye, which is more durable than brilliant ; it would take up too much time to mention the various particulars of each species. Charles, resume the subject of the oak.

*CHARLES.* There are many varieties of this useful tree, the different parts of each are capable of being turned to some advantage. Cork is the bark of a species of the holm oak. It grows in great abundance in Spain, Italy, France, &c. Depriving this tree of its bark does not injure it, for if timely care be not taken to strip it off, it splits and peels off of itself, being pushed up by another bark formed underneath. In order to prepare it for use, it is piled in heaps, in ponds or ditches, then flattened with weights, and dried. It is principally applied to purposes to which its peculiar quality of repelling moisture is adapted; such as soles for shoes, corks for bottles, and bungs for barrels. Waistcoats for swimming have also been made of it; its excessive lightness rendering it suitable for the purpose, as well as its power of repelling the water.

*Mr. HARCOURT.* The bark, or exterior covering of trees is not only useful to man for various purposes, but it is formed for the preservation of the trees also; it defends them from external injury, and preserves them from the cold, when it is too severe for their tender bodies. The reason that evergreens retain their leaves during the rigours of winter, is, because their barks are of a more oily quality than the bark of other trees. There are a great many kinds of barks in use in the several arts. They are considered as powerful restoratives and strengtheners in medicine. The bark of the alder is used in dying; that of a peculiar species of birch is converted by the Indians into canoes, capable of holding twenty persons. A kind of rope is made of the bark of willows and linden trees. The bark of the cocoa-tree forms the cordage of the Siamese, and most of the Asiatic and African nations. In the East-Indies they manufacture the bark of a certain tree into a kind of stuff or cloth; it is spun and dressed much after the manner of hemp: indeed flax and hemp, with all their toughness, are only the sap-vessels, or ligneous films of the bark of those plants. The East-Indian

thread, produced from bark, is of a middle kind between silk and common thread; they sometimes manufacture it alone, at others mix it with silk, as in gingham, &c.

*SOPHIA.* The ancients wrote their books on bark, before the invention of paper, particularly on those of the ash and lilia, or lime-tree. The outer bark was not suitable for this purpose, they made use of the inner and finer, called philyra.

*Mr. HARCOURT.* And so durable was its texture, that there are manuscripts written on it still extant, a thousand years old. Bark is also serviceable as a manure.

*HENRY.* Papa, I think you told me some time ago, that birdlime was made of the bark of the holly.

*Mr. HARCOURT.* Good boy, for remembering what you have been told; the usual method of preparing it, is by boiling it a sufficient time; the roots of hyacinths, asphodel, narcissus and the black bryony, afford a tough stringy juice, in great quantities, of the same kind.

*Mrs. HARCOURT.* I hope my Henry remembers also, that when he was told what materials composed birdlime, he was taught to despise its use. It is mean and unmanly to deprive a poor bird of its liberty, merely to gratify our inclinations, without being able to improve the condition of the little sufferer. And it is to be feared that, when naughty, thoughtless boys have smeared the boughs with this substance, they have sometimes forgotten to return to the place, and release the entangled prisoner, which, by their cruel neglect and carelessness, has been left to starve.

*CECILIA.* And it would be still more piteous, was that prisoner a parent bird; its innocent little nestlings must suffer also a lingering death.

*AUGUSTA.* My brothers have used birdlime, and set traps, without reflecting on the tortures they may have inflicted. I will repeat to them this conversation, and I am persuaded their hearts are too generous ever to be guilty of the same cruelty again.

*CHARLES.* I shall next mention the elm, as second to the oak in size and beauty. It is particularly, adapted to bear extremes of wet and dry, and therefore is frequently used for water-works, mills, pipes, pumps, aqueducts, &c. It is also suited to the purposes of the wheelwright. The fineness of its grain renders it fit for works of ornament, such as foliages, &c. In times of scarcity, when hay and fodder have been difficult to obtain, the dried leaves of the elm have been substituted as food for cattle. Charcoal made of elm is inferior to none but that of oak.

*SOPHIA.* If charcoal be made of wood, what process is used to transform it to that state?

*Mr. HARCOURT.* They begin the operation by clearing a circular piece of ground, of turf and other combustible matter. This space is filled with wood cut into pieces of about three feet in length, and laid in the form of a pile, with a stake driven into the centre; the whole is covered over moderately thick with turf and other rubbish; after setting up a moveable screen against the wind, the stake is pulled up, and the pile set on fire, by pouring well-kindled coals into the cavity. The wood chars without being consumed, by properly regulating the vent-holes, and keeping the mass covered. It is chiefly useful, where a clear strong fire, without smoke, is required. Mathematical instrument makers, engravers, &c. find charcoal very serviceable in polishing brass or copper-plates, after they have rubbed them clean with powdered pumice-stone. Charcoal and foot-black supply the painter and varnisher with the best and most durable black. One of the principal ingredients in making gun-powder is charcoal; but I do not mention this as an instance of its utility; happy would it be for mankind, did peace and good will prevail among them so powerfully, as to render such destructive inventions useless; but since this benign desire for universal harmony cannot be accomplished by the wishes of any one weak mortal, let each individual contribute his share

towards preserving private peace, by subduing and regulating his angry passions; and cultivating and improving his benevolent dispositions.

*Mrs. HARCOURT.* You have omitted to mention the baneful effects of the fume of charcoal; there have been many instances of persons who have been shut up in close rooms with charcoal fires in them, that have been found dead in a few hours. Charles, you must bear our interruptions with patience, you are now at liberty to proceed.

*CHARLES.* I consider them as valuable additions to the few observations I have been able to collect; nor could I go on, unless you and my father will condescend to assist me. The ash, next to the oak, is of most universal use: it serves the soldier for spears, the carpenter, wheelwright, and cartwright for ploughs, axle-trees, wheel-rings, harrows, and oars. It is useful to the turner, cooper, and thatcher, and is superior to all other kinds for garden palisades, hop-yards, poles, and spars.

*HENRY.* You told us that ships were built of oak; but I cannot think that the body of an oak, is either tall or straight enough to make the masts.

*CHARLES.* The masts are made of fir or pine, which are tall straight trees, adapted to the purpose; they love a chalky soil, and thrive well in a cold climate. Norway produces them in great abundance; they form that kind of timber commonly called deal, which is so much in use for floors, wainscots, &c. It is supposed that the enormous wooden horse, introduced by the artifice of Ulysses within the walls of Troy, and which was the means of destroying that famous city, after sustaining a siege of ten years, was formed of this tree.

*Mr. HARCOURT.* The pine and fir trees are not valuable for their timber only, but turpentine, pitch, rosin, and tar are made from them by the following simple process. In the spring, when the sap runs most freely, they pare off the bark of the pine tree, and cut a hole at the bottom to receive the sap;



as it runs down, it leaves a white matter, rather thicker than cream, which is substituted instead of white wax, in the making of flambeaux. The liquor that runs into the hole at the bottom, is ladled into a large basket; great part of this immediately runs through into stone or earthen pots, prepared to receive it, and forms the common turpentine. The thicker matter, which remains in the basket, is distilled with a large quantity of water, as long as any oil is seen swimming upon the surface of the water; which when skimmed off, is common oil, or spirit of turpentine. The matter, that settles at the bottom of the still, is yellow rosin. When they have obtained all they can from the sap of the tree, they cut it down, and hew the wood into billets, with which they fill a pit dug in the earth, and then set them on fire; whilst burning, there runs from them a black, thick matter, which is tar; if they desire to make it into pitch, they boil it without adding any thing to it, and the work is completed. Charles, continue your account.

*CHARLES.* The turner uses the wood of the beech-tree for dishes, trays, rims for buckets, trenchers, &c. The upholster forms it into chairs, stools, bedsteads, bellows, &c. The bark is used for floats for fishing nets, instead of cork. It is very subject to the worm, which unfits it for purposes, where duration is requisite; but various parts of it are applied successfully to lighter uses. Band-boxes, scabbards for swords, and hat-cases are made of the thin lamina, or scale of this tree, and then covered with thin leather or paper. The mast or fruit fattens deer and swine; squirrels, mice, and dormice greedily devour the kernels of the mast; and some of our most favourite singing-birds; such as thrushes, blackbirds, &c. are preserved by them during the season that other food is scarce. The leaves, which afford an agreeable shade from the rays of the sun in summer, make the best and easiest mattresses, if gathered in autumn. Walnut is valued by the joiner and cabinet-maker

for its beautiful variation of colour and grain, and is used in inlaid works.

*Mrs. HARCOURT.* Of late years the drawing rooms of people of fashion have been furnished with tables curiously inlaid with wood of various kinds, and the use of mahogany much laid aside. This gives scope for the exercise of taste in the artist, who, when at a loss for a colour in the natural wood, suited to his purpose, unites the art of colouring or staining it to that of design; festoons of flowers, fruits, birds, &c. admirably executed, decorate the chairs and other pieces of furniture, in the place of the heavy gilding that adorned the state rooms of our ancestors, who were more delighted with magnificence than elegance. The art of japanning and varnishing, which is now greatly improved, adds much to the beauty of painted or coloured wood. Substantial mahogany furniture is best suited to people, whose rank and fortune subject them to the rules of useful œconomy, and whose duty it is to prefer utility to splendor and shew. Sophia, do you recollect what country produces that species of cedar, the wood of which we call mahogany?

*SOPHIA.* It is a native of the warmest parts of America, abounding in the islands of Cuba, Jamaica, and Hispaniola.

*CHARLES.* There are many species of the cedar-tree; they were highly valued by the ancients for their durability and beauty. Solomon's temple and palace were both built with it, which is a mark of its high estimation. They grow to a very great size, and thrive best in a poor soil. The chestnut-trees that grow out of the lava of Mount Etna, in the island of Sicily, exceed any that I have heard of in magnitude. The agreeable traveller, Brydone, relates, that the most celebrated among these, is called the castagno de cento cavilla; and that it measures two hundred and four feet round, though said to be united below in one stem, and is a mighty bush of five large trees growing together. The hollow of one of these is supposed to contain one hundred sheep.

*Mr. HARCOURT.* Woods and groves were held sacred through all antiquity. The Pagans generally built their temples in or near them, and the druids and bards, who were the ministers of religion among the ancient Britons, held them in the highest veneration. Particular trees were frequently consecrated among the heathens to some favourite divinity. The laurel was devoted to Apollo, who presided over poetry and the fine arts; hence victors in the olympic games, successful poets, and conquering heroes have been rewarded with crowns of laurel. The myrtle was the favourite tree of Venus, and the vine appropriated to Bacchus. White poplar was used in the sacrifices of Jupiter, and the pine on the altar of Ceres. The Persian Magi burned their sacrifices with myrtle and boughs of laurel. The mythology of the Pagans extended the idea of the tutelary protection of woods and groves so far, as to believe that they were generally inhabited by dryads, or wood nymphs.

*Mrs. HARCOURT.* I am not surprised that minds uninstructed in the principles of true religion, impressed only by enthusiastic notions of the Deity, should be affected by the appearance of awe and solemnity that is felt on entering a thick impervious shade. Milton, in his *Il Penseroso*, seems sensible of the alliance between the gloom of a tall forest and melancholy enthusiasm. He says,

Me, Goddess, bring  
 To arched walks of twilight groves,  
 And shadows brown that Sylvan loves,  
 Of pine, or monumental oak,  
 Where the rude axe with heavy stroke  
 Was never heard the Nymphs to daunt,  
 Or fright them from their hallow'd haunt;  
 There in close covert, by some brook  
 Where no profaner eye may look,  
 Hide me from days garish eye, &c.

*CHARLES.* At the time of the Norman conquest, and for many years after, prodigious tracts of land in this island remained covered with forest trees and

underwood; they were not suffered to be cleared for the purposes of cultivation, lest the game, which took shelter in them, should be destroyed. Hunting was a favourite diversion with the kings and great men of that age, and they unfeelingly sacrificed the public welfare to their own private gratifications.

*Mr. HARCOURT.* As the number of inhabitants increased, agriculture gradually improved; the great power of the barons being diminished, the people at large became of more consequence, and it was found necessary to listen to their importunity, and convert some of these extensive royal forests into smiling corn-fields, the harbingers of comfort and plenty. It will be happy if the present generation do not run into the opposite extreme, and by neglecting the planting and preserving of timber, subject this country to the inconvenience and disadvantage of being supplied from a foreign market. Indolence, the love of present advantage, and want of attention to the good of posterity, are obstacles to the improvement and practice of this useful part of husbandry. Country gentlemen of fortune, who have leisure and money to advance, can hardly render their country a more acceptable service, than by raising valuable plantations of the best kinds of timber for the use of succeeding generations. Their reward must consist in the patriotism and benevolence of their intentions, and in the increasing value of their estates, as the period of the life of man gives no expectation of the planter enjoying the fruit of his own labour: an oak not arriving at perfection much short of a century. Charles, you must oblige us with a further account of this interesting subject to-morrow evening the time of separation is arrived. Adieu, my dear children.

## CONVERSATION XV.

*AUGUSTA.* I HOPE I am not come too soon, I was so impatient to hear a continuation, of last night's conversation, that I hastened tea, in order to be here early.

*Mrs. HARCOURT.* The same inclination seems to have drawn each of us here rather earlier than usual; a pleasing assurance, that our lectures are not tedious, but that our attendance is rather voluntary than forced.

*Mr. HARCOURT.* Instructions should always be rendered agreeable, in order to be beneficial to those that are to learn. The skill of a preceptor consists in gaining the affections of his pupils, and conveying knowledge in so gradual and clear a manner, as to adapt it to the strength of the young student's capacity. Many a poor child has been disgusted with books and learning, by the heavy laborious tasks that have been given him to learn by heart, before he was capable of understanding them. The spirit of improvement, that distinguishes this enlightened age, shines in nothing more conspicuously than in education. Persons of genius have not thought it unworthy of their talents to compose books purposely for the instruction of the infant mind, and various ingenious methods of facilitating the acquisition of knowledge have been invented.

*Mrs. HARCOURT.* The austere manners of former times secluded children from the advantage of conversing with their parents or instructors; an unnatural distance was maintained between them; they were seldom admitted into the parlour, but to pay a ceremonious visit. The great Duke of Sully relates, in his Memoirs, that his children were never suffered to sit at table in his presence on chairs with backs to them. The times are greatly altered in this respect for the better, and the familiar intercourse, that is now maintained with young people by their parents, and those who preside over their education, affords them an agreeable opportunity of enlarging their minds, and attaining a fund of knowledge, by the easy medium of conversation. The liberality, with which young persons are treated in the present times, promises still greater hopes of advantage in the culture of the heart and disposition, than in the improve-

ment of the faculties ; by substituting real affection and friendship, in lieu of that distant respect, which is only the shadow of it.

*SOPHIA.* I flatter myself, that there is not one of us, that is insensible to the privileges we enjoy, by the indulgence of our kind parents ; particularly that of being permitted, nay, encouraged to open our whole bosoms to them.

*AUGUSTA.* Forgive me, if I almost envy you this unspeakable comfort ; deprived of a mother, before I was capable of knowing my loss, I have been a stranger to those tender sensations, that unite the heart of a child to so dear a connection. My father, though extremely fond of me, is often obliged to leave me for months together, on account of business, to the care of a governess that I cannot love ; had I been so fortunate as to have been placed under such a woman as your Mrs. Selwyn, who treats you with kindness, is never angry without cause, and spares no pains for your improvement, I think I should have regarded her as an adopted mother, and loved her with equal tenderness ; but the caprice, ill-humour, and indolence of Mrs. Marchmont discourage me from endeavouring to please her ; and had it not been for the compassionate attention of my dear Mrs. Harcourt, I must ever have remained ignorant and self-conceited, confirmed in error, a slave to bad habits, and my unsubdued passions.

*Mrs. HARCOURT.* Your gratitude enhances the value of my friendship too highly ; you are the daughter of my particular friend, and I can never feel greater pleasure, than in paying a tribute to her memory, by doing you every service in my power. Charles, time passes swiftly, what tree do you begin with ?

*CHARLES.* I have finished my account of the principal trees used for heavy timber ; the peculiar uses of the light sorts of wood remain for me to mention. Lime is used chiefly in carving, and for such purposes as pill-boxes, &c. The twigs are made into

baskets and cradles, and all kinds of wicker-work. The inner bark has been used instead of paper. A copy of one of Cicero's works, written on this bark, was preserved as a great curiosity in Cardinal Mazarine's library.

*HENRY.* I have been often greatly amused by watching the basket-maker that lives in the village; he uses osiers as well as the twigs of the lime. The vast variety of things that he makes, with such simple materials, has surprised me; sometimes I have sat down and worked with him; and were I to become very poor, I think I could easily follow his trade.

*AUGUSTA.* Pray what variety of things does he make? I cannot recollect any thing but baskets.

*HENRY.* In the first place, baskets of various forms and sizes, flasks, hampers, cages, lattices, cradles, hurdles, wiers for fish, and many other things that I cannot remember. Hazel is the best for hurdles, fishing-rods, and springs to catch birds with.

*CECILIA.* Are not osiers a species of willow?

*CHARLES.* Yes, they are a kind of low willow found by the water-side; the wood of the willow, of late years, is come into great demand for the purpose of making ladies' hats. It is cut into thin narrow slips, by means of a machine, and woven into the form of a hat, which has a pretty effect. This kind of wood is suited to purposes that require elasticity; the elder, on the contrary, is adapted to uses that need toughness, such, as butcher's skewers, &c. Almost every part of this tree has its medicinal use, and pleasant-flavoured wine is made both from the flowers and fruit. Poplar is incomparable for all sorts of white wooden ware, as also for heels of shoes. The hardness of box, and readiness to take a polish, renders it very valuable to the turner for mathematical instruments, pegs, nut-crackers, weaver's shuttles, rulers, rolling-pins, pestles, tops, chessmen, screws, lace bobbins, spoons, combs, &c. Holly affords the whitest wood of any, and is used in making dressing-boxes, and other fancy-works.

*Mr. HARCOURT.* Almost innumerable are the uses, to which different parts of trees, growing in every temperature of the world, are applied. The bodies for timber, the bark, leaves, blossoms, fruit, gums, resin, manna, sugar, contribute to our accommodation, and are rendered, by art and ingenuity, subservient to our use. Some trees afford food, others, poison; the fibres of some supply us with cloathing, the timber of many with habitations; from some we extract medicines for the use of our maladies; from others, dyes of various hues; some are adapted to form musical instruments, by the sonorous quality of their wood; such as maple, fir, yew, and pear-tree: others, deficient in that property, compensate the defect, by excellence of a different kind. Every tree has its peculiar property, and scarce any but may be converted to useful purposes; their branches afford a lodging to birds, their berries supply them with food; numerous insects inhabit every part of them. Let us admire the wise œconomy of nature, that supports and nourishes one part of her works by the produce of another. The seeds alone of trees and plants, feed a vast number of animals, and yet there are a sufficient number left for the purpose of preserving their respective kinds.

*Mrs. HARCOURT.* The fecundity of vegetables is equally amazing with that of fishes. Mr. Ray asserts that one thousand and twelve seeds of tobacco weighed only one grain, and that from one tobacco plant, the seeds thus calculated amounted to three hundred and sixty thousand. The seeds of the ferns are, by him, supposed to exceed a million on a leaf. This numerous reproduction prevents the accidental extinction of the species, at the same time that it serves for food for the higher order of animation. Nature has provided in a wonderful manner both for the nourishment and preservation of the immature seed. Every seed possesses a reservoir of nutriment, designed for the growth of the future plant; this consists of starch, mucilage, or oil within the coat of the seed; or of



sugar, and sub-acid pulp in the fruit, which belong to it. In order to preserve them from injury, some are wrapped in down; as the seeds of the rose, bean, and cotton plant: others are suspended in a large air vessel, as those of the bladder-fena, staphylæa, and pea: many are furnished with a sort of wing or feather, as those of the thistle and anemone, which assists their conveyance by the wind from one place to another. There is a great analogy between the seeds of vegetables, and the eggs of animals and insects. They both include a perfect individual of their respective kinds, together with suitable nourishment to bring it to maturity, though the parts are far too minute for our investigation.

*AUGUSTA.* Is it possible that so large a tree, as that majestic oak, which we so often admire, could ever be contained in a small acorn?

*Mr. HARCOURT.* The fact admits of no doubt; in some plants the embryo is partly visible, by the assistance of the best microscopes; and as nature governs by general laws, it is fair to surmise that the other kinds are propagated in the same manner.

*SOPHIA.* Vegetables produce their seeds or embryo young unconsciously, and drop them on the ground, or suffer them to be waisted by the wind where accident directs. Insects shew a higher degree of instinct, and deposit their eggs where they are likely to meet with food suitable to their different natures; and, after providing for their future security, by placing them in a proper situation, die; or, if their short existence is extended beyond one season, leave them to be hatched by the sun, without further care. How superior is the parental solicitude of birds! after composing a habitation for the reception of the eggs, with much labour and ingenuity, with what patience do they confine themselves to the task of hatching them! They seem to have lost every desire for flying about, and sit day after day, till the young brood is hatched; their cares are then of another kind, they leave the nest, for a little while at first, to seek

for food, which they distribute equally to their young ones. Their anxiety is continued till the nestlings are capable of providing for themselves, when they seem to forget their past affection, and wholly abandon the objects of their former tenderness to their own management.

*Mrs. HARCOURT.* Instinct, or that quality in animals which corresponds with reason in man, is bestowed on each creature in proportion to its rank or order in creation. The gradation of being is something like the links of a mighty chain, the immediate distinctions of which are scarcely perceptible; but when we compare the mineral, vegetable, and animal kingdoms together, the superior excellence of the latter is obvious; as the lowest degree of animal life is above the highest vegetable production. Let us proceed still further, and make a comparison of the most inferior orders of animals, such as oysters, &c. which seem only to possess a bare existence, void of faculties or enjoyment, with man, a creature endowed with the noble quality of reason, capable of exercising very extensive intellectual powers, and enabled to understand, admire, and investigate the works of his great Creator.

*CECILIA.* I never was so sensible of my own dignity before.

*Mr. HARCOURT.* Beware, my dear child, of doing any action unworthy of a being of so exalted a rank in the scale of existence; at the same time, learn humility, from the recollection, that it is rational to believe, that there are degrees of intellectual beings, as much above man, as an oyster is below him. We have strangely wandered from our subject. Charles, are you prepared to give us an account of the poison tree, which you extracted from Dr. Darwin's notes on the Loves of the Plants?

*CHARLES.* The upas-tree is situated in the island of Java. It is surrounded on all sides by a circle of high hills and mountains; and the country round it, to the distance of ten or twelve miles from the tree,

is entirely barren. Not a tree, or a shrub, nor even the least plant or grass is to be seen. The destructive effluvia that proceeds from the tree is supposed to be the cause of this sterile appearance. The poison which is procured from this tree, is a gum that issues out between the bark and the tree itself, like the camphor. Malefactors, who are sentenced to die for their crimes, are the only persons, who collect the poison, and they are allowed this chance of saving their lives. After sentence is pronounced upon them by the judge, they are asked in court, whether they will die by the hands of the executioner, or go to the upas-tree for a box of poison? They commonly prefer the latter proposal, as there is not only some chance of preserving their lives, but also a certainty, in case of their safe return, that a provision will be made for them in future by the emperor. They are also permitted to ask a favour of the emperor, which is generally of a trifling nature, and usually granted. They are then provided with a silver box, in which they are to put the poisonous gum, and are properly instructed how they are to proceed, while they are upon their dangerous expedition. They are told to pay particular attention to the direction of the winds, as they are to go towards the tree before the wind, so that the effluvia from the tree is always blown from them. They are likewise directed to travel with the utmost dispatch, as that is the only method of ensuring a safe return. They are afterwards sent to the house of an old priest, who lives on the nearest habitable spot, appointed by the emperor to reside there, for the purpose of preparing the souls of those criminals for eternity, who are sent to the tree, by prayers and admonitions. To this place they are commonly attended by their friends and relations. When the hour of their departure arrives, the priest puts them on a long leathern cap, with two glasses before their eyes, which comes down as low as their breast, and also provides them with a pair of leathern gloves. Thus equipped, they are conducted by the priest and their

relations about two miles on their journey. Here the priest repeats his instructions, and tells them where they are to look for the tree. He shews them a hill, which they are to ascend, and that on the other side, they will find a rivalet, which will guide them to the upas. They now take leave of each other, and, amidst prayers for their success, the delinquents hasten away. Notwithstanding the precautions that are taken, there are scarcely two out of twenty that escape. It is certain that from fifteen to eighteen miles round this tree, not only no human creature can exist, but that, in that space of ground, no living animal of any kind has ever been discovered. Every man of quality has his dagger or other arms poisoned with the gum of this destructive tree; and in times of war, the Malayans poison the springs, and other waters with it; by this treacherous practice the Dutch suffered greatly during the last war, as it occasioned the loss of half their army. For this reason, they have ever since kept fish in those springs of which they drink, and centinels are placed near them, who inspect the waters every hour, to see whether the fish are alive. If they march into an enemy's country, they always carry live fish with them, which they throw into the water, some hours before they venture to drink of it, by which means they have been able in some degree to provide for their security.

*SOPHIA.* This is a very extraordinary account. How happy is it for mankind that these baneful trees are not commonly found: so subtle and irresistible does their poisonous influence seem to be, that were they scattered in different places, they might destroy all animals and vegetables, and change this beautiful world into a barren waste.

*Mrs. HARCOURT.* The most useful and beneficial things are bestowed in greatest plenty, which is an instance of the Divine goodness, that calls for our daily gratitude.

*AUGUSTA.* Of what use can the upas-tree be;

would it not have been better, if such trees had never been created?

*Mrs. HARCOURT.* The wisdom of the Almighty, in the order of the creation, and our limited capacity to judge the good of the whole, is a sufficient reply to such questions. But perhaps such instruments of destruction are permitted to make us sensible of our happy situation, and the many blessings we enjoy; at the same time, they serve as monuments of that power that can destroy a guilty world by a variety of means; and may have some influence to restrain the vices of those who are principally affected by sensible objects. The Caoutchouc, or Indian rubber, being the produce of a tree, some account of the manner of its preparation will not be foreign to the present subject. Cecilia will be kind enough to tell us something concerning it.

*CECILIA.* It consists of a very elastic resin, produced by a tree, which grows on the banks of the river of the Amazons. It grows to a very great height, perfectly straight, having no branches except at top. Its leaves bear some resemblance to those of the manioc: they are green on the upper part, and white beneath. The seeds are three in number, and contained in a pod, consisting of three cells, not unlike those of the palma christi; and in each of them there is a kernel, which being stripped and boiled in water, yields a thick oil or fat, which the natives use for the same purposes that we do butter. The juice, which is applied to many different uses, is collected chiefly in time of rain, because it flows then most abundantly. They make an incision through the bark, and there issues from it a milky liquor. It is said, that the means employed to harden it, is kept a profound secret. Though some assert, that it thickens, and becomes gradually solid by being exposed to the air. As it becomes solid, it shews an extraordinary degree of flexibility and elasticity. The Indians make boots of it, which water cannot penetrate: they have a method of smoking them, that makes

them look like real leather. Bottles are also made of this substance, to the necks of which are fastened hollow reeds, so that the liquor that is contained in them may be squirted through the reeds by pressing the bottle. One of these, filled with water, is always presented to each of their guests at their entertainments, who never fail to make use of it before eating.

*HENRY.* How I should laugh to see a company of people squirting water at each other!

*Mrs. HARCOURT.* There are various customs in different countries, that appear strange and unaccountable to the eye of an unprejudiced stranger, and seem to have arisen from caprice or accident. Habit renders us insensible to the absurdity of those we see constantly practised. Is it not as reasonable to wish health and happiness to our friends, at every mouthful we eat, as at every glass we drink?

*HENRY.* It might be quite as reasonable, but it would appear very comical.

*Mrs. HARCOURT.* Civility requires that a traveller should comply with the customs of the countries through which he passes, provided they be perfectly harmless and innocent. Cecilia, continue your account of the caoutchouc.

*CECILIA.* Flambeaux made of this resin give a brilliant light, and have no bad smell. A kind of cloth is also prepared from it, which the inhabitants of Quito apply to the same purposes as our oil-cloth, or sail-cloth. It is also formed into a variety of figures by means of earthen moulds, that serve both for use and ornament.

*Mr. HARCOURT.* Ever since this resin has been known in Europe, its chemical qualities, and other interesting properties, have been very diligently investigated. Its solidity, flexibility, and elasticity, added to its quality of resisting the action of aqueous, spirituous, saline, oily, and other common solvents, render it extremely fit for the construction of tubes and other instruments, in which these properties are

wanted. You have all experienced its usefulness in drawing, by erasing the erroneous strokes of black lead pencils, which has occasioned many to call it, Lead-eater. Were we acquainted with the different properties of all the forest-trees, that grow in the various climates of the earth, the subject would be almost inexhaustible, and would furnish us with new matter of admiration of the power and wisdom that formed them, and endued each with its peculiar distinction. Of those that are known, we have only mentioned the most obvious and striking, and such as we are familiar with by name, from using their productions. Children, recollect whether you cannot enrich our list, by adding an account of any trees remarkable for their produce or beauty, which Charles has forgotten or omitted.

*SOPHIA.* The nutmeg-tree is found in the East-Indies, and is said to resemble a pear-tree; the fruit is inclosed in four covers; a thick fleshy coat, something like that of the walnut, contains the whole, which opens of itself when ripe: under this lies a thin reddish kind of net-work, of an agreeable smell and aromatic taste, which we call mace; and is as valuable as the fruit itself: the shell is the third covering, and is hard, thin, and blackish; under this is a greenish film, of no use, and in it is found the nutmeg. According to Tavernier, birds are the instruments of propagating these trees by eating the nutmegs, and afterwards dropping them undigested upon the ground, and being softened and prepared for growth by the heat of the stomach, they readily take root. These birds are not permitted to be killed, on account of this circumstance, as the productions of this tree afford a very lucrative branch of commerce to the Dutch East-India Company, who monopolize the spice-trade, and by that means render it very profitable. Nutmegs and mace give an elegant flavour to high-seasoned dishes, and are frequently used in medicine.

*AUGUSTA.* I have seen and used the different kinds

of spices, without ever reflecting on their nature, are cinnamon and cloves also the produce of trees?

*SOPHIA.* Cinnamon is the bark of a tree, chiefly growing in the island of Ceylon, and cloves are the fruit of a tall tree found in different parts of the East-Indies.

*Mrs. HARCOURT.* The tropical climates far excel those that approach nearer the Poles, in the beauty of the feathered race; their colours are more vivid, and dazzle with a richness and brilliancy, that the inhabitants of our groves are not adorned with; but, as if Nature took delight in dividing her gifts, they are deficient in the variety and extent of their tuneful powers, and must yield to the superior music of our warblers. In the vegetable productions, they rise above us also in magnitude, luxuriancy, and fragrance. The groves of pimento-trees in the West-Indies fill the air with their odours; their fruit is a small berry, which we call allspice, because it partakes of the flavour of many of the spices of the East. The pimento refuses the culture of man, and flourishes best when it grows spontaneously. It is a tree of great beauty; the trunk is of a grey colour, smooth and shining; it produces beautiful white flowers, which blow in the months of July and August. The leaves are equally fragrant with the fruit, and yield an odoriferous oil, which, when distilled, frequently passes for oil of cloves.

*SOPHIA.* Dr. Hawkesworth relates that the bread-fruit is found at Otaheite, in the South-Sea, on a tree about the size of a middling oak. It is as large as our gourds, and the surface covered with a kind of network. The eatable part lies between the skin and the core: it is as white as snow, and of the consistence of new bread. It has an insipid sweetish taste, resembling that of the crumb of wheaten bread, mixed with a Jerusalem artichoke. It is roasted and baked before it is eaten, and admirably supplies the place of bread, to a people ignorant of the arts of cultivation.



*CECILIA.* I must not suffer my favourite mulberry-tree to be forgotten; when adorned with the yellow cones of the silk-worm, like so many balls of gold, I think its appearance must equal the beauty of any you have mentioned; and we owe to the insect it nourishes and maintains, the most delicate and agreeable texture that we wear; therefore you must allow it is inferior to few in usefulness.

*Mr. HARCOURT.* Cecilia is determined to defend her favourite with spirit; and indeed she has done it ably, for without the mulberry-tree, we must relinquish the use of silk, so well adapted to the clothing the inhabitants of warm climates, and which contributes so much to the elegance and magnificence of dress and furniture in all countries, where it is known; but, my dear children, where time is spent agreeably, it also passes swiftly. Our hour of separation is already past. Let us retire, and seek that repose, which is necessary to refresh our weary spirits, and invigorate us for the pursuits of to-morrow.

## CONVERSATION XVI.

*Mr. HARCOURT.* **O**UR late conversations on the subject of the various kinds of timber have led me to consider their extensive use in the building of ships; whether for the purpose of conveying us to the distant regions of the earth, or transporting the productions of one climate to its opposite extreme.

*HENRY.* Pray, tell us how they first contrived to build a ship; it must be very curious to know the manner of putting the parts together on the water.

*AUGUSTA.* I am far more desirous of being informed of the name of the man, who had sufficient courage to venture upon so unstable an element.

*Mrs. HARCOURT.* A long period of time was necessary to bring either navigation, or the art of constructing vessels, to any degree of perfection. The

first efforts were rude and imperfect. Observation taught the early inhabitants of the earth that light substances floated upon the surface of the water : experience, that sure but slow guide, instructed them, that any thing would swim, that displaced a body of the fluid equal to its own weight. It is probable that the inhabitants of countries bordering on the sea, at first only ventured close along the shore, on a few planks fastened together, and pushed themselves along by the assistance of a stick or pole : repeated attempts suggested various improvements, till by degrees, men became capable of building floating houses, and sailing in them to the most distant regions of the earth. The advancement of science in general, still contributes to improve and perfect the invention of constructing vessels, and guiding them through the pathless ocean. That small instrument, the mariner's compass, said to be the contrivance of Flavio, a Neapolitan, about the beginning of the fourteenth century, has been of the greatest advantage in enabling persons at sea to know the course they are pursuing. It principally consists of a needle of iron, impregnated with the magnetic powers of the loadstone, which influences it always to point nearly to the north : thus, by being exactly acquainted with one of the cardinal points, it is easy to find out the others. As Charles is a better classical scholar than I am, I leave him to reply to Augusta's query.

*CHARLES.* It is supposed that Neptune, called by the pagans, god of the sea, was the founder of these inventions, and that his discovery was immortalized by attributing to him the dominion of the element he had subdued. Many give the honour to Dædalus, and imagine that the wings he is said to have invented, to save himself from the resentment of Minos, king of Crete, whom he had offended, were nothing but sails, which he applied to the vessel in which he escaped ; but all these accounts are uncertain. Scripture affords us some authentic records. Noah was certainly one of the earliest ship-builders; and the

ark the first large vessel that is mentioned in history. Profane history relates an extraordinary account of two other ships of prodigious magnitude; the first built by order of Ptolemy Philopater, king of Egypt, which carried four thousand rowers, four hundred sailors, and three thousand soldiers; the other belonged to Hiero, king of Sicily, and was built under the direction of Archimedes. It contained all the variety of apartments belonging to a palace; banqueting-rooms, galleries, gardens, fishponds, stables, mills, baths, a temple of Venus, &c. and to render it complete, it was encompassed with an iron rampart, and eight towers, with walls and bulwarks, furnished with machines of war.

*Mr. HARCOURT.* When the history of a very remote period records events that exceed rational belief, it is reasonable to suppose, that the circumstance related was regarded as extraordinary at the time it happened; and that the historian, desirous of transmitting the fame of his native country to posterity, has enlarged the fact, and related it in the glowing colours of fiction. In this light I consider the description of Hiero's vessel. But to return to the simple inventions of the earliest navigators, the various tribes of savage nations, that inhabit the sea-coast, will throw the best light on the subject. Canoe is the name given to the little boats generally used by those who dwell in both Indies, as well as by the negroes in Guinea. They generally make them of the trunks of trees hollowed out, and sometimes of pieces of bark fastened together: they differ in size, according to the tree of which they are made; they are rowed with paddles, something like the oars of a boat, and but rarely carry sails. The loading is placed at the bottom; but, as they have no ballast, they are frequently turned upside down. The want of a rudder, with which they are not furnished, is supplied by the hind paddles. The negroes of Guinea use the same sort of canoe, though made in a different manner: they are long shaped, having only room for one

person in width, and seven or eight in length, and shew but little of the wood above the water. Those accustomed to row them are extremely dexterous, not only in striking the paddles with cadence and uniformity, by which the canoes seem to skim along the surface of the water; but also in balancing the vessel with their bodies, and preventing their overturning, which, without this address, must continually happen from their extreme lightness; but what is still more extraordinary, that when this accident does occur, many of them have the dexterity to turn them up again even in the water, and remount them.

*CECILIA.* I have often remarked, that savages shew great ingenuity in their simple contrivances, and that they excel the inhabitants of civilized countries in personal address and dexterity. What European can vie with some of the Indians in running, when they pursue their game in hunting? or in patience, whilst they suffer the want of food, when they happen to be disappointed of obtaining it in the woods? The art with which they contrive stratagems in war, to deceive their enemies, shews great cunning and skill; though I despise the principle, I admire the fertility of their invention. When I reflect upon their superiority in these things, I am discontented, because I cannot find a satisfactory reason why ignorance should excel knowledge in any thing.

*Mr. HARCOURT.* There are many causes why a savage should perform acts of skill and dexterity, in a manner superior to a person, whose mind has been enriched by the cultivation of science; but there can exist no instance of ignorance being preferable to knowledge. The intellectual powers of a savage, though capable of receiving the same impressions, as a man of science, are, from want of education, confined to very few objects; on those he bestows his whole attention, and consequently attains a great degree of perfection in the things that belong to them. Do you not think that Charles would jump better than any of his acquaintance, if he passed whole days or weeks in no other occupation but that exercise?

*CECILIA.* Certainly; I have no doubt of it.

*SOPHIA.* The subsistence of savages depends so much upon their success in fishing and hunting, that, without skill in these arts, they must frequently be destitute of provisions; it is likely, therefore, that their whole education consists in attaining this dexterity. Although they manage their canoes with such surprising cleverness, I suppose they do not venture far out to sea.

*MR. HARCOURT.* Seldom to a greater distance from shore than four leagues. They weave mats with rushes, of which they make the sails. On return from a voyage, the canoes are not left in the water, but drawn on shore, and suspended by the two ends, till they are dry, in which state they are so light, that two men can easily carry them on their shoulders. Different causes have operated in forming the peculiar character of different nations. The narrowness and poverty of the land inhabited by the Phœnicians and Tyrians, combining with their natural genius for traffic, rendered them the first nation of navigators among the ancients. Lebanon and the other neighbouring mountains supplying them with excellent wood for ship building, they were in possession of a numerous fleet before other nations had acquired any knowledge in the art beyond that of coasting in small vessels. The commerce they established with foreign countries by the means of their skill in naval affairs, enriched them to an extraordinary pitch of opulence. The employment given to such numbers of hands, by this enterprising and commercial spirit, increased the population of the country to such a degree, that they were obliged to found colonies in other countries, the principal of which was that of Carthage. In time, Carthage became more powerful than the mother country, and extended her navigation into Europe, as far north as Britain. The rivalry that subsisted between the states of Carthage and Rome for many years, ended in the total destruction of the former, and left Rome without a compet-

itor. This celebrated city in her turn became the prey of the Goths and Vandals, and with her fell, not only learning and the polite arts, but also the useful one of navigation declined, rather than advanced for some time. The Crusades, that monument of human folly and enthusiasm, contributed to restore and accelerate the revival of commerce and navigation, by the number of vessels that were necessary to convey those vast armies into Asia, on this wild enterprise. The invention of the compass, combined with the voyages of discovery and other causes, to promote the advancement of this useful branch of science, and raise it to its present state.

*CHARLES.* Which of the nations of Europe patronised the early voyages of discovery?

*MR. HARCOURT.* Had John II. of Portugal listened to the proposal of Columbus, who was a native of Genoa, to give him encouragement to explore a passage to India, by sailing towards the west, across the Atlantic Ocean, that nation might have claimed this honour; but John treated his scheme with contempt; and Columbus, disgusted with his behaviour, quitted Portugal, and went to Spain, in order to apply to Ferdinand and Isabella, who reigned conjointly at that time. Eight years were spent in repeated applications before he succeeded. At length, in August 1492, this great man, furnished with a small fleet of three ships, set sail, and steered directly for the Canary Islands; from thence he proceeded due west, through unfrequented and unknown seas; and after many difficulties, arrived at Guanhani, one of the large cluster of islands, called the Bahama Isles, and returned to Spain, without having obtained his principal object, of discovering another continent, which he supposed to exist on the western side of the globe. He made a second voyage without any better success. Undaunted by so many disappointments, he undertook a third voyage and actually fell in with the vast continent of America; which, after all his indefatigable labour, received its name from a Flor-

entine, Americus Vesputius, who only followed the footsteps he had marked out. Succeeding navigators made new discoveries, and Portugal at length saw the advantage of patronising these enterprises. It does not seem that our countrymen turned their attention this way till a later period. In 1577, Sir Francis Drake undertook, and completed a voyage round the world, in about three years. Our later discoveries have been principally in the Pacific Ocean, and, to the honour of the British nation, the name of Captain Cook will ever remain distinguished among the chief navigators. It was not the thirst of digging the gold from the mine, but the desire of diffusing the arts and advantages of civilization among his fellow creatures, that induced him to explore unknown seas. He wandered from one nation of strangers to another, offering the olive branch of peace, and desired rather to form an alliance of friendship with them, than to oppress them by tyranny and injustice.

*CHARLES.* Although England is now celebrated for the superiority of her navy, it appears that the northern parts of the world were slow in attaining this perfection; for, when Cæsar invaded Britain, the natives opposed him in vessels of an odd form, like large tubs, the sails were composed of leather, and iron chains supplied the place of cables.

*Mrs. HARCOURT.* The Saxons, after being some time settled in this island, became sensible that its surest defence would be a formidable navy, and applied themselves vigorously to build ships of war. Ethelred, in order to maintain a powerful force at sea, made a law, that whoever possessed 300 hides\* of land, should build and man one ship for the defence of his country. Our insular situation has obliged us to bestow great attention in improving and advancing the art of ship-building to perfection. It is also our best policy to encourage a nursery of British sea-

\* A hide of land was formerly reckoned 100 acres.

men, which is done in part by the numbers that are employed in the Newcastle colliers, and other trade fleets. This is the reason that coal pits in the neighbourhood of London are not suffered to be worked. The superiority of the British fleet for strength and beauty, as well as for the bravery of its mariners, is undisputed, and our nation has long been considered as mistress of the sea.

*SOPHIA.* In the reign of Queen Elizabeth our royal navy was in a very flourishing condition.

*Mr. HARCOURT.* The progress of commerce and navigation naturally keep pace together. Trade first gave occasion to the fitting out large fleets of ships, and as that increased, the cargoes became more valuable, and each nation, jealous of her property, found ships of war necessary to convoy her merchantmen in safety to their destined ports. Ships, intended for different purposes, required a variety of forms and sizes, as well as diversity of construction and rigging. The form of fishes being admirably adapted to divide the fluid element, and make a way through the waters, furnished hints to ship-builders in forming the hulks of vessels. Naval architecture comprehends three principal objects. In the first place, it is necessary to give the ship such an exterior form, as may be best suited to the service for which she is designed. Secondly, to find the proper figures of all the pieces of timber that compose a ship. And lastly, to provide suitable accommodations for the officers and crew, as well as for the cargo, furniture, provisions, artillery, and ammunition.—A ship of war should be able to sail swiftly, and carry her lower tier of guns properly; it is necessary for a merchant-ship to contain a large cargo of goods, and be navigated with few hands; and each kind should be able to carry sail firmly, steer well, drive little to leeward, and sustain the shocks of the sea without being much strained. Charles you have visited a dock-yard, can you give your brother a satisfactory account of the method used in building ships?



*CHARLES.* The vessels, that I saw building, were supported in the dock; or upon a wharf, by a number of solid blocks of timber, placed parrallel, and at equal distances from each other. The workmen call this being on the stocks.

*Mr. HARCOURT.* This is an answer to your enquiry, Henry, how they contrived to build ships upon the water: had you reflected a moment, you would not have asked such a silly question.

*HENRY.* I asked without considering that it would be impossible. Forgive me, if I am now desirous of knowing how such large bodies are removed into the water.

*Mrs. HARCOURT.* I commend a proper curiosity; but, in future, before you ask a question, consider whether it be a reasonable one, and whether by reflection on the subject, you cannot resolve it yourself. When they begin to build a ship, it is supported upon strong platforms, inclined towards the water. All things being ready for the launch, the wedges and supporters are cut away, and the parts over which the vessel is to pass, are well daubed with grease and soap, to make her slide more easily. Every obstruction being removed, by degrees she slides into the water. Very large vessels are frequently built in dry docks, and when finished, the flood-gates of the dock-yard are opened, and the water rushes in, and raises the vessel to the surface. Charles, are you able to recollect the principal parts that compose a ship? I took some pains to make you master of the subject. :

*CHARLES.* It is a difficult one, but I will endeavour to give the company the clearest idea of them in my power. The first piece of timber laid upon the block is generally the keel; the pieces of the keel are scarped together, a term used for fastening large pieces of timber together in a manner somewhat similar to what the carpenters call dove-tail; thus united, they form one entire piece, which constitutes the length of the vessel below. At one extremity of the keel is erected the stem, which is a circular piece of timber,

into which her two sides are fixed at the fore end: at the other extremity of the keel, is elevated the stern-post, into which are fastened the after-planks, and in the stern-post hangs the rudder. The transoms and fashion pieces are large pieces of timber that form the width of the ship. These being strongly united into one frame are elevated upon the stern-post, and the whole forms the structure of the stern, upon which the galleries and windows, with their ornaments, are afterwards built. The stem and stern post being thus elevated upon the keel, and the keel being raised at its two extremities by pieces of wood, the midship floor timber is placed across the keel. The floor timbers, both before and abaft\* the midship frame is then stationed in its proper place upon the keel; after which the kelson, which is the next piece of timber to the keel, and lying directly over it, is fixed across the middle of the floor timber. The futtocks, or ribs, which form the sides, are then raised upon the floor timbers, and the top timbers being afterwards fastened to the head of the futtocks, completes the exterior figure of the whole.

*Mr. HARCOURT.* Considering the subject is so intricate, you have described it with tolerable clearness.

*Mrs. HARCOURT.* You have given us an idea of the external figure of a ship, the inside finishing also requires a great deal of art. It is divided into several decks or floors, destined to different uses. Large ships have three decks, smaller but two, and there are vessels that are only half decked. The decks are divided into several apartments. The best cabin, for there are sometimes more than one, corresponds with the drawing-room of a house, and is appropriated to the reception of visitors. The cuddy serves for an eating-parlour; there is also on board an Indiaman a cabin, behind the cuddy, called the round-house. Besides these, separate apartments are provided for the different officers, as cook-room, gun-room, &c.&c.

\* *Abaft, a sea term for behind.*

*HENRY.* Do they lie in such beds as we do?

*Mrs. HARCOURT.* They would find them very inconvenient, on account of the motion of the ship; they use hammocks at sea, which are beds hung to the ceiling, and they swing backwards and forwards as the ship rolls.

*Mr. HARCOURT.* A ship is very imperfectly described without naming the masts, sails, and rigging. The masts are very tall poles fixed in the deck, to which are attached the sails and the rigging. The sails are generally made of a peculiar kind of coarse hempen cloth, and their use is to gather the wind, by the force of which the vessel is driven along; the rigging is composed of ropes, and serves to furl and unfurl the sails as occasion requires; it also forms a sort of rope-ladders, by which the expert mariners ascend to the top of the mast.

*CÉCILIA.* It must require a vast sum of money to build a ship.

*Mr. HARCOURT.* A man of war of 74 guns is calculated to cost 30,000*l.* before she is armed or equipped.

*CHARLES.* What an immense sum must be requisite to raise and maintain a fleet! Into how many orders or ranks is the British fleet divided?

*Mrs. HARCOURT.* It is distributed into six rates, exclusive of the inferior vessels that usually attend on naval armaments; as sloops of war, armed ships, bomb-ketches, fire-ships, &c. Ships of the first rate mount an hundred cannon, they are manned with 850 men, including officers, seamen, marines, and servants. A captain of a man of war, when on board, is an absolute sovereign, and rules with unlimited sway, but on his return is liable to give account of his conduct in a court martial, as it is a principle of the British constitution, that every subject, of whatever rank, if injured at sea or land, has an equal right to redress.

*AUGUSTA.* Pray what difference is there in the meaning of the words ship and vessel?

*Mr. HARCOURT.* Vessel comprehends all floating

machines, that move in water: we distinguish them into two general classes; high-bottomed, or decked vessels, which are those that move wholly with wind and sail, and live in all seas; and flat-bottomed vessels, which go both by oars and sails, such as boats, barges, wherries, &c.

*HENRY.* You mentioned a rudder just now, I do not know what it is.

*Mr. HARCOURT.* The rudder is a piece of timber suspended to the stern-post, by which the vessel is guided, in this or that direction, according as the sides of the rudder are opposed to the water. An anchor is a large strong piece of iron, crooked at one end, and formed into two barbs, resembling a double hook, and fastened at the other end by a cable; its use is to keep the vessel confined to one place, by letting it down into the ground.

*Mrs. HARCOURT.* As it is sometimes their last resource, in time of danger, it is considered as emblematical of hope, which is frequently represented by a female figure, resting upon an anchor, and looking up to heaven for deliverance.

*SOPHIA.* Are not flags displayed on the masts of ships, to denote to what nation they belong?

*Mr. HARCOURT.* They not only serve that purpose, but also distinguish the rank of the admiral or commander on board. In the British navy the flags are either red, white, or blue. The admiral or commander in chief carries his flag on the foremast, and that of the rear-admiral is carried on the mizen-mast. Different signals are used at sea, according to circumstances; and, during an engagement, the orders of a commander are given and understood with wonderful precision. James II. is said to have invented the principal signals used in our fleet.

*CECILIA.* I cannot imagine how the poor sailors avoid running against the rocks in a dark night.

*SOPHIA.* Light-houses are erected in proper situations, to warn them of their danger, where such large fires are made as to be visible at a considerable dis-

ance. The Pharos of Alexandria was a building of this kind. It was esteemed one of the seven wonders of the world, on account of the beauty of its structure, and the richness of its materials. It stood on a small island at the mouth of the Nile, and consisted of several stones raised one over another, adorned with columns, ballustrades, and galleries of the finest marble and workmanship, to which account some writers add, that the architect contrived to fix mirrors so artificially against the highest galleries, that all the vessels, that sailed on the sea for a considerable distance, were reflected in them.

*Mrs. HARCOURT.* The clock strikes, and warns us that it is time to retire. Henry has been so attentive, that I expect he will dream of undertaking a voyage.

*HENRY.* I wish I may, by that means I should enjoy the pleasure without partaking of the danger.

*Mrs. HARCOURT.* Good night, my little, sleepy sailor. Adieu, dear children.

CONVERSATION XVII.

*HENRY.* I HAVE longed all the day for the time of meeting. I have been thinking of several things concerning ships, which appear wonderful to me: in the first place, I cannot imagine how they contrive to store up provisions for so many people for several months without spoiling; we are obliged to go to market almost every day, but you know there are no shops at sea.

*Mrs. HARCOURT.* Consequently the ship's crew cannot live on fresh meat, neither can they procure fresh vegetables, which, with the want of fresh water, are the principal causes of that dreadful disease, called the sea scurvy; to which persons in long voyages are very subject. Beef and pork, well salted down, with hard biscuit, form the usual food of a sailor.

*AUGUSTA.* I cannot eat either salt-meat or hard

biscuit ; what would become of me, were I obliged to go to a very distant country ?

*SOPHIA.* Necessity, my dear Augusta, has taught many to submit to great hardships ; I suppose your father were obliged to go to the West-Indies, would you prefer being separated from him, or attending him thither, and suffering some inconveniences for a few weeks ; surely you would not hesitate which to chuse ?

*AUGUSTA.* My father frequently tells me, that it is not unlikely that his affairs will require his presence in Jamaica. I have entreated him to let me go with him, but I never considered the difficulties of the voyage. Accustomed as I have been to a variety of dishes every day at table, and a dessert of fruit and preserves afterwards, I should find it hard fare to dine on salt-beef and biscuit, and to exchange my soft bed for a hammock.

*MR. HARCOURT.* This confession shews the great inconvenience of an habitual indulgence in our mode of living ; had you been used to eat only of one dish, and sleep upon a mattrafs, you might easily have accommodated yourself to an alteration for the worse for a little time. Temperance is not only a virtue, but a great advantage to health, and on many occasions diminishes the difficulties we are liable to meet with. One reflection ought to be sufficient to reconcile us to any temporary hardship, that thousands of our fellow creatures suffer daily, what we think so painful to undergo for a few hours. The consideration of these things will teach us to transfer a little of that solicitude for our own personal enjoyment, to a tender care for the wants and sufferings of others.

*CHARLES.* The captains and officers have their tables supplied with fresh provisions ; sheep, pigs, and poultry are kept on board ships for that purpose. I have also seen a cow which afforded milk and cream for the captain's table. Minced meat and sweet-meats are generally among his stores, and any other delicacy that will keep ; therefore, Augusta, you

may lay aside your apprehensions, for although you could not enjoy all the luxuries you do at home, you may make a tolerable shift for a month or two.

*CECILIA.* The comparison of my condition, and that of the poor sailors, would prevent my enjoyment of the indulgences, that my superior rank procured me.

*Mrs. HARCOURT.* Bring that principle home to your own heart; you constantly enjoy many gratifications, that our poor neighbour Mary Benson has not even an idea of.

*CECILIA.* That very thought reconciles me to the difference; but were she a spectator of my daily meals, and obliged to rest contented with her present scanty fare, I should be induced to go shares with her.

*Mr. HARCOURT.* Our wants vary according to our habits and education; let us be careful not to increase them by pampering a false taste for unnecessary indulgence; a life of hardship is not confined to sailors, many employments subject those who are engaged in them, to endure it patiently. Miners are deprived of light, and the society of the rest of mankind. Those who work in the quicksilver mines are said not only to lose their health, but generally die in a few years; extremes of heat and cold, hard labour, and scanty fare are the portion of the greater part of mankind; but happiness does not depend upon the enjoyment of luxury; these people possess as large a share of it, as their richer and envied neighbours; each condition has its advantage; we are the children of one common parent, who has deemed it wise to distribute mankind into different ranks and orders in society, and to render the poor and the rich dependent on each other, that they may be united by the powerful tie of reciprocal benevolence and affection.

*SOPHIA.* I believe I should suffer most from want of fresh water; what contrivance do they use as a substitute for this necessary comfort?

*Mr. HARCOURT.* Many ingenious philosophers have bestowed much time and attention to remedy this defect; the simplest and best method of distilling

sea-water, and rendering it fresh, is the invention of Dr. Irving. In order to have a clear idea of his method of accomplishing this desirable purpose; suppose a tea-kettle to be made without a spout, and a hole in the lid in the place of the knob; let this kettle be filled with sea-water, the fresh vapour, which arises from the sea-water, as it boils, will issue through the hole in the lid; fix the mouth of a tube in that hole, and the vapour of fresh water will pass through the tube, and may be collected by fitting a proper vessel to receive it to the end of the tube. Dr. Irving, in a similar manner, has adapted a tin, iron, or copper tube, of suitable dimensions, to the lid of the common kettle, used for boiling the provisions on board a ship. The fresh vapour, which arises from boiling sea-water in the kettle, passes through this tube into a hoghead, which serves as a reservoir.

*CHARLES.* This is ingenious, and may alleviate the evil in a degree; but I cannot suppose it can be so agreeable as clear fresh water from a spring, and it must be scarcely possible to procure a sufficient quantity for the comfortable accommodation of so many persons.

*Mrs. HARCOURT.* Fresh water is often far more precious than the richest wines on board a ship; the poor men have frequently been obliged to be limited to a certain quantity of it in a day. True riches consist in a sufficiency of those things that are necessary to our life and health. Of what use would gold be to a man in a desert? a cup of cold water, or a sack of corn would be, in comparison, an inestimable treasure.

*CECILIA.* Surely it must be difficult to preserve the health of persons confined long on board, especially in warm climates.

*Mr. HARCOURT.* A considerate humane commander pays great attention to the health and morals of his ship's company; cleanliness, and the free admission of fresh air between decks, are points of the utmost importance, as well as a sufficient supply of



such vegetable food as can be preserved ; as peas, oatmeal, &c. After every precaution that can be taken, there are inconveniencies peculiar to this manner of life.

*HENRY.* The desire of seeing foreign countries, with the different manners and customs of the inhabitants, would influence me to face every danger, and overcome every difficulty.

*MR. HARCOURT.* Henry is quite a hero ; many have felt an invincible inclination for going to sea, which cannot be accounted for, on any other principles, than that men are formed with various propensities, adapting them to a variety of pursuits. Were it otherwise, all men would chuse the easiest profession, and no one would be found to undertake any employment, that threatened either difficulty or danger.

*AUGUSTA.* In relating the progress of navigation, crusades were mentioned ; I should be glad to be informed what they were, as I am entirely ignorant of the meaning of the word.

*MRS. HARCOURT.* Towards the end of the eleventh century, the zeal of a fanatical monk, called Peter the Hermit, who conceived the idea of leading all the forces of Christendom against the infidels, and of driving them out of the possession of the Holy-Land, was sufficient to give a beginning to this wild undertaking. He ran from province to province with a crucifix in his hand, exciting princes and people to this holy war. Wherever he came, they caught the infection of his enthusiasm, not only nobles and warriors, but men in the more humble stations of life : shepherds left their flocks, and mechanics their occupations ; nay, even women and children engaged with ardour in this enterprise, which was esteemed sacred and meritorious ; contemporary authors assert, that six millions of persons assumed the cross, which was the badge that distinguished such as devoted themselves to this holy warfare. But from these expeditions, extravagant as they were, beneficial consequences arose, which had neither been foreseen nor

intended. It was not possible for the crusaders to travel through so many countries without receiving information and improvement, which they communicated to their respective countries, at their return. The necessary provision and accommodation for such vast numbers of people excited a spirit of commerce, and in its consequences advanced the progress of navigation; a spirit of improvement is raised by the communication of different nations; those people, who are destitute of commerce, remain a long time stationary.

*SOPHIA.* How often do we see good arise out of apparent evil? Who could have supposed that the mistaken enthusiasm of an obscure monk could have been productive of such public benefit?

*Mr. HARCOURT.* It is useful to trace things to their causes; many events, that have made great noise in the world, have arisen from causes apparently trifling, and inadequate to the effects produced. The means of introducing the reformation into this country, with all its happy consequences, was the unlawful love of Henry VIII. for Anne Boleyn. He sought only his own gratification; but the hand of Providence converted his corrupt inclinations into an instrument of good to his people. Discoveries in the arts have frequently been the result of accident. This should teach us the habit of observation. The bulk of mankind observe little, and reflect less, which accounts for many persons in advanced life having few ideas of their own.

*CECILIA.* You have so often inculcated the advantage of observing the nature and texture of every thing we use, that it is become an amusing custom, when we are by ourselves, to question each other on the qualities of those things that attract our notice. This morning at breakfast, tea, coffee, and chocolate were the subjects of enquiry; none of us were capable of giving a good account of them, without having recourse to books for information; we each chose our topic, and I believe Henry can inform us in what

manner coffee is cultivated and prepared. Charles selected the cacao-tree for his investigation. The tea-tree of course fell to my share.

*Mrs. HARCOURT.* Pray let us be amused with the result of your researches. Cecilia, your brothers will not take the lead, they resign the precedence to you.

*CECILIA.* The tea-tree, according to Linnæus, is of the polyandria monogynia class; the cup is a very small, plane, permanent, perianthium, divided into five or six roundish obtuse leaves; the flower consists of six or nine large roundish, concave, and equal petals; the stamina are numerous filaments, about two hundred, and are very slender, capillary, and shorter than the flower; the antheræ are simple: the germen of the pistil is globose and trigonal; the style is subulated, and of the length of the stamina; the stigma is simple; the fruit is a capsule, formed of three globular bodies growing together; it contains three cells, and opens into three parts at the top. The seeds are single, globose, and internally annulated. It is supposed that there is but one species of this tree, and that the difference between green and bohea tea, consists only in the manner of cultivation, and drying the leaves. The root resembles that of the peach-tree, the leaves are long and narrow, and jagged all round. The flower is much like that of the wild rose, but smaller; the fruit contains two or three seeds of a mouse colour, including each a kernel. These are the seeds by which the plant is propagated; several of these are put promiscuously into a hole, four or five inches deep, at proper distances from each other, and require no other care. In about seven years, the shrub rises to a man's height, which it seldom greatly exceeds.

*Mr. HARCOURT.* You have forgot to tell us of what country this shrub is a native.

*CECILIA.* It is cultivated in Japan, and grows abundantly in China, where whole fields are planted with it, as it forms a very extensive article of com-

merce among the Chinese. It loves to grow in valleys, at the foot of mountains, and upon the banks of rivers, where it enjoys a southern exposure to the sun, though it endures considerable variations of heat and cold, flourishing through the different degrees of climate in the extensive kingdom of China. Sometimes the tea-trees grow on the steep declivities of hills, when it is dangerous, and in some cases impracticable to get at them. The Chinese are said to make use of the large monkeys, that dwell among these cliffs, to assist them in obtaining the valuable leaves of the tea-trees; they irritate these animals, and, in revenge, they climb the trees, and break off the branches, and throw them down the precipice, which gives the gatherers an opportunity of reaching them.

*AUGUSTA.* What part of this shrub is applied to our use?

*RECILIA.* The leaves constitute the tea we use; the best time to gather them is whilst they are small, young, and juicy; they are plucked carefully one by one; and, notwithstanding the tediousness of this operation, the labourers are able to gather from four to fifteen pounds each, in one day. The buildings, or drying houses, that are erected for curing tea, contain from five to twenty small furnaces, each having at the top a large flat iron-pan. There is also a long low table, covered with mats, on which the leaves are laid, and rolled by workmen, who sit round it; the iron pan being heated to a certain degree, by a little fire made in the furnace underneath, a few pounds of the fresh gathered leaves are put upon the pan, the fresh and juicy leaves crack when they touch the pan, and it is the business of the operator to shift them as quick as possible with his bare hands, till they become too hot to be endured. At this instant he takes off the leaves with a kind of shovel, and pours them on the mats before the rollers, who, taking small quantities at a time, roll them in the palms of their hands in one direction, while others

are fanning them, that they may cool the more speedily, and retain their curl the longer. This process is repeated two or three times, or oftener, before the tea is put into the stores, in order that all the moisture of the leaves may be thoroughly dissipated, and their curl more completely preserved. On every repetition the pan is less heated, and the operation performed more slowly and cautiously; the tea is then separated into the different kinds, and deposited in the store for domestic use or exportation. The Chinese drink tea more frequently than the Europeans; it is the chief treat, with which they regale their friends; and it is said, that it is a branch of polite education in that country, to learn to infuse and serve it gracefully. It was introduced into Europe, very early in the last century by the Dutch East-India company. About the year 1666, a quantity of it was imported from Holland, by Lord Arlington, and Lord Ossery, at which time it was sold for sixty shillings a pound. The present consumption of it is immense, nineteen millions of pounds being annually imported since the commutation act took place.

*SOPHIA.* I think this agreeable beverage is reckoned unwholesome.

*CÆCILIA.* The faculty reckon it very much so, to some constitutions, particularly low nervous habits; at the same time, they allow that the same quantity of warm water might be nearly as prejudicial; therefore I am willing to drink it cool, provided I may be permitted to enjoy this enlivening repast, which always seems superior in sociability and cheerfulness to every other meal in the day.

*Mr. HARCOURT.* At the same time that you mention its pernicious qualities, it is but fair to remark, that it is in some cases valued as a medicine, and is acknowledged to be the most powerful restorative to the spirits after fatigue of body or mind.

*Mrs. HARCOURT.* The general use of it among the poor and laborious part of mankind, I consider baneful to them in many respects: it consumes a large part of their scanty earnings,

that might be expended in more nutritious food, and though it gives a temporary animation to their wearied spirits, it is not capable of renewing their strength, exhausted by the fatigues of the day; the same money laid out in milk would be more beneficial and nourishing to themselves and their infants; not that I would wholly deprive them of this solace, but I believe it would redound to their advantage, if it were only used occasionally by way of treat.

*CECILIA.* I have no addition to make to my account; therefore I hope Charles is ready to begin.

*CHARLES.* The cacao, or chocolate-nut, is a native of South-America, and is said to have been originally conveyed to Hispaniola from some of the provinces of New Spain, where it was not only used as an article of nourishment by the natives, but likewise served the purpose of money, being employed as a medium in barter; one hundred and fifty of the nuts were considered as nearly equivalent to a ryal by the Spaniards. It is a genus of the polyadelphia pentandria class; the flower has five petals, and five erect stamina; in the centre is placed the oval germen, which afterwards becomes an oblong pod, ending in a point, which is divided into five cells, filled with oval, compressed, fleshy seeds. The cacao-tree, both in size and shape, has some resemblance to a young black-heart cherry-tree. The flower is of a saffron colour, extremely beautiful, and the pods, which, when green, are much like a cucumber, proceed immediately from all parts of the body and larger branches. Each pod may contain from twenty to thirty nuts or kernels, not unlike almonds. These nuts are first dried in the sun, and then packed for market, and after the parchment shell, in which they are involved, is removed, they require but little preparation to be made into good chocolate.

*HENRY.* You are not to be let off so easily, Charles, you must give us an account of the process.

*CHARLES.* The Spaniards were the first that introduced the use of chocolate into Europe. The

method of preparing it, first practised by them, was very simple, and the same with that in use among the Indians: they only used cacao, maize, and raw sugar, as expressed from the canes, with a little achiote or rocou, to give it a colour: of these four drugs, ground between two stones, and mixed together in a certain proportion, they made a kind of bread, which served them equally for solid food, and for drink; eating it when hungry, and steeping it in hot water when thirsty. The Spaniards have since added many ingredients in the composition of their chocolate, which are thought to add but little to its quality. In England, the chocolate is simply ground with but little other addition than sugar and vanilla, which is the fruit of a plant cultivated in South-America. These ingredients together are made up into such cakes, as we see in the grocer's shops; when purchased for domestic use, it requires to be boiled in water, milk, or water-gruel; when sufficiently boiled, it is milled or agitated with a wooden machine for the purpose, and boiled again, in order to froth it; then mixed with sugar and cream; it forms a favourite breakfast at the table of the opulent, and serves to gratify their taste for variety.

*Mr. HARCOURT.* Your account has hitherto been very entertaining; but I hope you can furnish us with the manner in which this beautiful and useful tree is cultivated, as I have been told that there are few vegetables that require more care to rear and bring to maturity.

*CHARLES.* The first business of the planter is to chuse a suitable spot for the purpose. A deep black mould is the soil best adapted to the growth of the chocolate-tree; it should be a level piece of land, sheltered round with a thick wood, so as to be well screened from the wind, especially the north; after having cleared it from all manner of stumps and weeds, the planter digs a number of holes; at eighteen or twenty feet distance. Having previously selected the largest and fairest pods of the cacao, when

full-ripe, he takes out the grains, and puts them into a vessel of water; such of them as swim he rejects, the others, being washed clean from the pulp, and skinned, are suffered to remain in the water till they begin to sprout, when they are fit for planting. His next work is to take the leaves of the banana, or some other large leaf, one of which he places in the circumference of each hole, so as to line it within side; leaving the sides of the leaf some inches above the ground, after which he rubs the mould in very lightly, till the hole is filled; three nuts are then chosen for each hole, and planted triangularly, by making a small opening for each with his finger, about two inches deep, into which he puts the nuts with their end downwards, from which the sprout issues, and having lightly covered them with mould, he folds the edges of the leaf over them, and places a small stone on the top, to prevent its opening. In the space of about eight or ten days, the young shoots begin to make their appearance above the earth, and call once more for the attendance of the planter, who unfolds the banana leaves, that the growth of the tender plant may not be impeded; in order to shelter them from the sun, other leaves or branches are placed round the hole, and they are changed as often as they decay, during five or six months. Such tender care does the cacao require, and so requisite is shade to its growth and prosperity, that, besides the precautions I have mentioned, they are obliged to plant some other tree to the south-west of the plant, which may grow up with it, and serve it for shelter against the scorching rays of the sun; the erythina, or bean-tree, is generally chosen for this purpose. In the fifth year it begins to repay the cultivator for his trouble, and by the time it has stood eight years, attains its full perfection. It generally produces two crops of fruit in the year, and will sometimes continue bearing for twenty years. The same delicacy of stamina, which characterises its infancy, is apparent in all the stages of its growth.



for it is obnoxious to blights, and shrinks from the first appearance of drought, and the greatest part of a whole-crop of cacao-trees have been known to perish in a single night without any visible cause.

*AUGUSTA.* I am surpris'd that any person has the patience and perseverance to cultivate a shrub, that requires so much pains, and after all, so liable to disappoint the hopes of those who have reared it, at the expence of such a great deal of time and labour.

*Mrs. HARCOURT.* I imagine that the profit it brings, when it succeeds, is the inducement to the attempt; nothing is to be effected without pains and labour; we cannot learn the simplest mechanical operation without repeated efforts; consider what numberless attempts an infant makes to walk or speak, before it can either articulate a perfect sound, or proceed a few steps by itself. In the same manner, the habit of performing most of the common operations of the body, which we practise, as it were insensibly, when we have arrived at maturity, are acquired by almost imperceptible degrees: a child learns to judge of the distances of objects by experience, as of the distance and nature of sounds. The powers of smelling, tasting, feeling, hearing, and seeing, exist in a new born infant, though a considerable space of time passes, before it is capable of reaping much benefit from them; repeated and continual practice, at length enables it to see, hear, taste, feel, and smell, with accuracy and precision, if it be born with perfect organs. This should teach us never to despair of attaining any degree of perfection in virtue or knowledge, of which our nature is capable. If indolence, pride, avarice, or anger, are the leading propensities of a man's disposition, let him war with determined resolution and unremitted care against that particular vice, to which he feels himself prone, and he will certainly come off victorious in the combat; resistance against a predominant inclination is at first painful, by repetition it is rendered easy, and

in time the practice of the opposite virtue becomes delightful.

*Mr. HARCOURT.* The possibility of overcoming vicious inclinations, and correcting what is commonly called our nature, is finely exemplified in the story of Socrates and the physiognomist. A man, who pretended to discover the characteristic marks of the disposition and affections, by the lines of the face, was introduced to Socrates, without knowing the philosopher, and desired to declare, by the rules of his art, what kind of person Socrates was. He replied, after observing his countenance attentively, that he was a drunkard, and a glutton, passionate, and a slave to vice in general. Upon which the company ridiculed his want of discernment, and denied all dependance on the truth of physiognomy; but Socrates reproved their rashness, acknowledging that in his youth he felt himself powerfully inclined to the very vices the man had named, but that perseverance and resolution had enabled him to overcome them, and all present knew that he had attained such command over himself, as to be celebrated as a model of virtue and morality. My dear Henry must lay aside his intention of entertaining us with the history of coffee, till to-morrow evening. It is too late to begin a fresh subject. Adieu; adieu.

### CONVERSATION XVIII.

*Mrs. HARCOURT.* I HAVE not forgotten that little Henry is to open the conversation to night, with an account of the peculiarities of the coffee-tree. Pray, try to repeat the botanical definition properly; speak clearly and distinctly, and arrange your ideas in order; if your memory should fail, your father or Sophia will assist you with pleasure, therefore be encouraged to proceed; we are all attention.

*HENRY.* After such kind encouragement from my dear mother, I have no excuse for declining the per-

formance of my promise, though I feel myself scarcely equal to the task. The coffee-tree is a genus of the pentandria monogynia class; the flower has one petal, which is funnel shaped; it has five stamina, which are fastened to the tube, the roundish germen afterwards becomes an oval berry, containing two seeds, in shape like a half globe, flat on one side, and convex on the other. This tree originally came from Arabia Felix; but is now cultivated with success in the British West-Indies. It is a low tree, even in its native soil, seldom exceeding sixteen or eighteen feet high. In the West-India islands the negroes are employed to gather the berries; as soon as they change their colour to a dark red, they are fit for gathering. Each negro is provided with a canvas bag, with a hoop in the mouth of it, to keep it open; it is hung about the neck of the picker, who occasionally empties into a basket; and if he be industrious, he may pick three bushels in the day. One hundred bushels in the pulp, fresh from the tree, will produce about one thousand pounds weight of merchantable coffee.

*Mr. HARCOURT.* You have given us a very clear account of this tree, and the manner of gathering the berries; you must next inform us of the method used in the drying them.

*HENRY.* There are two methods in use of curing or drying the bean. The one is to spread the fresh coffee in the sun, in layers about five inches deep on a sloping terrace, or platform of boards, with the pulp on the berry, which in a few days ferments, and discharges itself in a strong acidulous moisture; and in this state the coffee is left, till it is perfectly dry, which, if the weather is favourable, it will be in about three weeks. The husks are afterwards separated from the seeds by a grinding mill, or frequently by pounding them with pestles in troughs, or large wooden mortars. The other mode is to pulp it immediately as it comes from the tree, which is done by a pulping-mill; the pulp and the bean (in its parchment skin or membrane which encloses it) fall pro-

miscuously together ; the whole is then washed in wire sieves, in order to separate the pulp from the seeds ; the latter are then spread open in the sun to dry. After this follows the operation of grinding off the parchment skin, which covers the bean, and is left after the pulp is removed. When it appears sufficiently bruised, it is taken out of the trough, and put to the fan, which clears the coffee from the chaff, and the seeds remaining unground, are separated by sieves, and returned to the mill, which finishes the process.

*Mrs. HARCOURT.* The coffee-berries are generally roasted before we use them. They are put into a tin cylindrical box, full of holes ; through the middle of which runs a spit : beneath this machine is placed a semi-circular hearth, in which is lighted a large charcoal fire : by help of a jack the spit turns swiftly, and in that manner roasts the berries equally. When the oil rises, and is become of a dark brown colour, it is emptied into two receivers, the bottoms of which are iron plates : then the coffee is shaken, and left till almost cold ; and if it looks bright and oily, it is a sign it is well done. Sophia, you are doubtless acquainted with the manner of boiling it for use.

*SOPHIA.* Take a sufficient quantity of the berries for the present purpose, and grind them to a fine powder in an iron coffee-mill. Infuse this powder in a suitable proportion of boiling water, let this infusion just boil again, and stand till it is clear, and pour it off for use ; the addition of cream and sugar heightens and improves the flavour.

*CECILIA.* The Turks are remarkably fond of coffee ; they flavour it with cloves, or essence of ambergris ; and so essential do they deem it to their comfort, that it is one of the necessaries with which a Turk is obliged to furnish his wife.

*Mr. HARCOURT.* Avarice has invented many substitutes for coffee ; peas, beans, rye, and barley, when roasted, yield an oily matter, resembling it in a degree, but much inferior in strength and flavour.

*AUGUSTA.* Many other things are sent to this country from the West-Indies, besides sugar, coffee, and chocolate.

*CHARLES.* Ginger is produced there in abundance; there are three species; the first, which is the common ginger, is cultivated for sale in most of the islands in America; but is a native of the East-Indies, and also of some parts of the West-Indies, where it is found growing naturally without culture. The dried roots of this sort furnish a considerable export from the British colonies in America. The only distinction between the black and the white ginger consists in the different modes of curing the roots. The black is rendered fit for preservation by means of boiling water, and the white by exposing it to the sun; as it is necessary to select the fairest and soundest roots for this purpose, white ginger is commonly one third dearer than black in the market.

*Mr. HARCOURT.* This root is planted much in the same manner as potatoes in Great-Britain; but is only fit for digging once a year, unless for the purpose of preserving it in syrup. In that case it must be taken up at the end of three or four months, while its fibres are tender and full of sap.

*HENRY.* Preserved ginger is a nice sweetmeat; I remember we had some of it at the entertainment given on account of Sophia's birth-day.

*Mrs. HARCOURT.* Most of the preserves that come from the West-Indies, are excellent, owing to the fineness of the sugar, of which they make the syrup, which, whilst it prevents the fruit from decaying, does not destroy its flavour, or colour.

*CHARLES.* What are the principal commodities returned from England to the West-Indies, in exchange for the things we receive from thence?

*Mr. HARCOURT.* The manufacturers of Birmingham and Manchester; the clothiers of Yorkshire, Gloucestershire, and Wilts; the potters of Staffordshire; the proprietors of all the lead, copper, and iron works, have a greater vent in the British West-

Indies, for their respective commodities than they themselves perhaps conceive to be possible. The export of the coarser woollens to the torrid zone, for the use of the negroes, is prodigious; even sugar itself, the great staple of the West-Indies, is frequently returned them in a refined state, and thus furnishes an article of commerce in a double way.

*Mrs. HARCOURT.* Commerce and traffic, either between nations or individuals, may be divided into two great articles, under one of which all the rest may be classed, viz. the raw material, or natural substances, before they are changed or transformed by the inventions of art, such as corn, wool, iron, &c. and the various productions of nature, wrought and altered into innumerable compositions, by the industry and ingenuity of man. The globe, which we inhabit, may be compared to a vast storehouse, where an infinite variety of raw materials are laid up, ready for the exercise of invention and diligence. Few things in their natural state are adapted to our use, though scarcely the meanest is void of utility, when compounded with other substances, or transformed by the action of fire, or changed by chemical processes, or wrought by manual labour: a convincing proof, that a life of sloth and inactivity is not suited to our nature, and that no rank, however exalted, is exempt from labour. The vegetable, mineral, and animal kingdoms equally contribute to furnish matter for us to work upon. You may remember that the clear, transparent, beautiful ware, we call glass, is formed only of sand and ashes; and you will presently be informed that the elegant manufacture of porcelain, or China-ware, is composed of stones. Sophia, pleased with the account of tea, coffee, and chocolate, thought the tea-equipage would be completed, by the description of the process used in making China, and in consequence, has desired me to furnish her with information on the subject, that she might be enabled to amuse you with the result.

*AUGUSTA.* Stones! how is it possible to produce

any thing so smooth, glossy, and delicate as China from them? and I am still more at a loss to conjecture how they can be formed into such variety of shapes and figures, or by what means they can be united into such large flat surfaces, as dishes, bowls, &c.

*SOPHIA.* By first grinding them to a very fine powder, and afterwards making them into a smooth paste.

*HENRY.* Paste is soft and yielding, and will not retain its shape when handled.

*SOPHIA.* It must be hardened by fire, before it is in a condition for use.

*CHARLES.* I have read that the Chinese, the inventors of this curious art, are extremely secret, and so jealous of the eye of strangers, that they will not allow the Europeans to go beyond the suburbs of those cities, where factories are established, lest they should discover the mysteries of their different manufactures.

*Mr. HARCOURT.* That is a just representation of them. They are equally unwilling to communicate knowledge or receive instruction, and if we except the traffic carried on with the different nations of Europe at Canton, they have scarcely any intercourse with the rest of the world. Missionaries from the society of Jesuits have indeed been admitted even into Peking, their capital city, on account of their skill in astronomical knowledge, which recommended them to the notice of the Chinese emperors and grandees, though the object of their journey was the propagation of Christianity. Most of them being men of intelligence and learning, have bestowed attention on whatever they saw, that was curious or useful, and some of them have been enabled to transmit their observations to Europe; from this source, the most authentic information on the manufacture of porcelain has been obtained, and was sent to the Grand Duke of Tuscany. But Sophia, I do not intend to intrude upon your province, we expect our information from you.

*SOPHIA.* It will give me great pleasure, if I am

capable of affording any entertainment. The art of making porcelain is one of those in which the oriental nations have excelled the Europeans; it is chiefly manufactured in China, from whence it takes its name, but it is also brought into Europe, from other parts of the East, particularly Japan, Siam, Surat, and Persia. Neither the inventor, nor the period of its invention, is known, the Chinese annals being silent on the subject.

*Mr. HARCOURT.* Although we must acknowledge that the Orientals are superior to us in this art, yet Europe has established manufactures for several years, that have produced wares but little inferior to those of our eastern masters. The first European porcelains are said to have been made in Saxony. France followed her example, then England, afterwards Germany and Italy. Each of these manufactures differed from those of Japan and China, and respectively possess a distinct character of its own.

*Mrs. HARCOURT.* Connoisseurs in porcelain have valued some of the produce of the manufacture of Meissen, a few miles from Dresden, the capital of Saxony, at even a higher rate than those of China: on account of the superior excellence of the painting and enamelling. The Saxons attribute the invention to an alchymist, named Betticher, who was confined in the castle of Koningstein, by the king of Poland, on a suspicion that he was master of the secret of the philosophers stone, which was supposed by credulous persons, to possess the power of converting all metals into gold. Unable, with all his efforts, to obtain the subject of his researches, he employed his leisure in more useful experiments, and discovered the means of making a ware, which by its excellence and value, continues to enrich his country. His death happened in the year 1719. Among the French porcelains, that of the late king's manufactory at Sevres is the most esteemed. The Chelsea China is but little inferior to those of Saxony and France, but being expensive, and adapted chiefly to ornamental purposes, is of no



very general advantage. Of the other manufactories established in this country, that of Worcester is best suited to common use, as it wears well, and comes cheap. Sophia has acquainted herself with the materials, and manner of manufacturing this commodity in the porcelain works in China, which will be sufficient to give us a general idea of the subject, without entering into the particulars of the manufactures of Europe, they being all formed upon one principle, however they may vary in minute differences.

*SOPHIA.* M. Reaumur bestowed great pains in analysing the component parts of the eastern China, and found that it consisted of two substances, one of which is easily vitrified, or converted into glass, the other possessing a contrary quality; the combination of those opposite materials produces porcelain, which is a half vitrified substance, or manufacture, in a middle state, between the common baked earthen ware of our coarse manufactures, and true glass. This composition makes a very curious article in commerce, and not less so in natural history. In order to proceed with method, I shall consider four things; the materials that compose it; the art of giving the proper figure and shape to the different works; the colours with which it is painted, gilded and enamelled; and lastly, the baking, or exposing it to the proper degree of fire. There are two kinds of earths, and as many different oils, or varnishes, used in the composition of porcelain. The first earth, called kaolin, is intermixed with glittering corpuscles; the second, named petunse, is plain white, but exceedingly fine. They are both found in quarries twenty or thirty leagues from Kingteching, the name of the town where the most considerable China-works are carried on, and to this place, these earths, or rather stones, are brought in a number of little barks, incessantly passing up and down the river Iacotcheou for that purpose. The petunses are cut from the quarries in form of bricks, being naturally

pieces of a very hard rock ; those are mostly valued, of which the colour inclines to a greenish hue. The first preparation of these bricks is to break and pound them, till they are rendered impalpable, or as fine as can be conceived. This powder is thrown into an urn, full of water, and stirred briskly about with an iron instrument. After letting it stand still a while, the lighter parts of the powder form a skim on the surface of the water, several inches thick, which the workmen carefully skim off into another vessel filled with water, leaving the heavier sediment at the bottom to be reground. The second vessel is left to settle, and when it has stood long enough, they pour off the clear water, and reserve the matter, which subsides, for use : when it is nearly dry, it is cut into square pieces, and afterwards mixed with kaolin in proper proportion. The kaolin is much softer than the petunse, when dug out of the quarry ; yet this is the ingredient, which, by its mixture with the other, gives strength and firmness to the work. The mountains, whence the kaolin is dug, are covered on the outside surface with a reddish earth. The mines are deep, and the matter is found in glebes or clods. They prepare both these stones in a similar manner.

*CHARLES.* Pottery in general is made of clays or argillaceous earths, because they are capable of being kneaded, and easily receive any form, and acquire solidity and hardness, by exposure to the fire ; but I observe that porcelain is formed of the hardest rocks, reduced to an artificial clay or paste, by grinding them fine, and softening them with liquids.

*SOPHIA.* The oils, that are added, soften them, I suppose, in a still greater degree, and render their texture smooth and uniform. The first oil or varnish is a whitish liquid substance, drawn from the hard stone of which the petunses are formed ; they chuse the whitest squares, and those that have the most streaks of green in them for making the oil ; they prepare the petunses for this purpose in the same manner as for making squares ; when reduced to

this state, it is mixed with a mineral stone, called shekau or kehao, resembling alum, which they first heat red hot, and then reduce into an impalpable powder; this gives the oil a consistence, but it should not be made too thick, as it is still to be kept in a liquid state. The fourth ingredient is the oil of lime, which requires a more tedious and difficult process. After dissolving large pieces of quick lime, and reducing them to a powder, by sprinkling water on them, they put a layer of fern on this powder, and on the fern, another of the slacked lime, and so on alternately, till they have heaped a moderate pile, to which they set fire; when the whole is consumed, they compose another pile of layers of the ashes, and new layers of dry fern, which they burn as before; this operation is repeated five or six times, the oil being reckoned better, the oftener the ashes are burned. A quantity of these ashes of fern and lime is thrown into an urn filled with water, and to one hundred pounds of ashes, is added one pound of shekau, which dissolves in it; the rest of the process is the same as in preparing the earth of the petunses: the sediment found at the bottom of the second urn, kept in a liquid state, is called the oil of lime, from which the porcelain derives its principal lustre.

*CECILIA.* I am not surpris'd at the superiority of porcelain to common earthen ware, now I am acquainted with the various processes used to render the materials suitable to the elegant purpose for which they are designed.

*Mrs. HARCOURT.* As you have described the materials of this manufacture, and the manner of preparing them for their several uses, we must be contented to reserve the account of the various methods of forming them into vessels, figures, &c. till a future opportunity, as a particular engagement obliges me to leave you rather earlier than usual this evening.

## CONVERSATION XIX.

*AUGUSTA.* **M**Y father has promised to take me tomorrow, to see a gentleman's museum, which is filled with rarities and valuable curiosities; among other things, he tells me that there are several philosophical instruments, and that I am to see a variety of experiments. I should anticipate a great deal of pleasure in this visit, were I not entirely ignorant of the subjects with which I am to be entertained; so many things arise in my mind, which I wish to enquire about, lest I should expose my ignorance before strangers, that I find it difficult to select the questions most necessary to ask.

*Mrs. HARCOURT.* A consciousness of our defects is the first step towards improvement; a young lady of your age is not expected to be deeply skilled in philosophy; much less to display her knowledge, should she possess a small share; but a general acquaintance with the uses of the most common philosophical instruments is not only ornamental, but also a very useful accomplishment, and should form part of every liberal education.

*AUGUSTA.* My father mentioned several particulars, that are to be shewn me; telescopes, microscopes, and an orrery especially; but I am quite unacquainted with the purposes to which any of them are applied.

*Mr. HARCOURT.* In order to prepare your mind for your intended visit, we will defer our conclusion of the porcelain manufacture till our next meeting, and endeavour to explain the uses to which some of the most common philosophical instruments are applied. To enter into a description of their construction, or an explanation of their parts, would be uninteresting and tedious, unless we had the machines before us. We will begin with the telescope, as presenting the most conspicuous, important, and noble objects in nature. It is an optical instrument, con-

sisting of several glasses or lenses, fitted into a tube, through which remote objects are viewed as if near. Before the invention of the telescope, the wonders of the heavens were concealed from us beyond the powers of the naked eye; and astronomy, that exalted science, which illustrates the Omnipotence of the Divine Creator of the universe more eminently than any other branch of human knowledge, has been improved, and brought, by this simple instrument, to a degree of perfection unthought of, in former ages. The discovery was owing to chance rather than reflection, as it is certain, that the theory, upon which it depends, was not known when the first telescopes were made. Several claimed the honour of the invention but Galileo, in the beginning of the seventeenth century, having been told of a certain optic glass made in Holland, which brought distant objects nearer to the eye considered by what means this effect could be produced, and grinding two pieces of glass into form as well as he could, fitted them to the ends of an organ pipe, and with this indifferent apparatus shewed at once the novelty and wonder of the invention to the Venetian noblesse, on the top of the tower of St. Mark. From this time Galileo devoted himself wholly to the improving and perfecting of the telescope, and by his perseverance deserved the honour, usually attributed to him, of being the inventor of the instrument, and of its receiving the denomination of Galileo's tube, from his name. The Doge of Venice rewarded his assiduity with the ducal letters, and doubled his salary.

*Mrs. HARCOURT.* The extraordinary talents of this great man improved the first invention of the telescope to a vast degree of perfection; but it has been reserved for the period in which we live, to advance the magnifying powers to a height at once truly astonishing. Our cotemporary, Dr. Herschel, has made surprising progress in celestial geography, if I may be allowed the expression, by means of his Newtonian seven feet reflector, the most powerful instrument of the kind ever seen. It has enabled him to

discover many stars before unknown, and curious particulars relative to those with which we were previously acquainted.

*CHARLES.* When the immense and inconceivable distances of the fixed stars are considered, it is wonderful to reflect that the inventive powers, of such a diminutive animal as man, have ever attained to such degrees of information on a subject apparently so far beyond his reach.

*HENRY.* I do not think that the stars are so very far distant. On a clear night I have observed them but a little way above my head. I have tried several times to count them, but they are so numerous that I have always found it impossible.

*CHARLES.* You are very much deceived, my dear brother, in both respects. The stars, that are visible to the naked eye, are not so numerous as we are apt to suppose, from viewing them in a confused irregular manner; a thousand is supposed to be the greatest number even seen in our hemisphere at one time, by the keenest eye, and most attentive observer. Their extreme distance conceals them from our sight, except when they are unveiled by the assistance of telescopes, for they are really numerous beyond our limited imagination to conceive; and in order to give you a faint idea of their vast distance, I will relate a few observations that I have heard upon the subject. Nothing, that we know, is so swift in its passage as light; a ray of light passes from the sun to the earth in eight minutes and thirteen seconds, a distance of ninety-five millions; one hundred and twenty-three thousand miles; and yet, though possessing this amazing velocity, it would be one year and a quarter traversing the space between us and the nearest fixed star. A cannon ball, discharged from a twenty-four pounder with two-thirds of its weight of powder, moves at about the rate of nineteen miles in a minute, but would be seven hundred and sixty thousand years passing from the nearest fixed star to our earth. Sound, which travels at the rate of nearly thirteen miles in a minute, would be one million,

one hundred and twenty thousand years in passing through the same space.

*CECILIA.* How far does the structure of the universe, viewed in this light, exceed the bounds of the strongest imagination! well might David express his sense of those wonders, by exclaiming, that the Heavens declare the glory of God, and the firmament sheweth his handy work.

*SOPHIA.* Addison remarks, that the universe is the work of infinite power, prompted by infinite goodness, having an infinite space to exert itself in, so that our imagination can set no limits to it.

*Mrs. HARCOURT.* The microscope is an instrument calculated to shew the other extreme of nature's works, by magnifying very minute objects, so as to render that clear to the sight, which from its minuteness, was before imperceptible. Dr. Hooke, who has written on the microscope, divides the objects proper to be viewed by it into three classes, which he calls exceeding small bodies, exceeding small pores, and exceeding small motions. Small bodies must either be the parts of larger bodies, or things, the whole of which is too minute for our observation, unassisted by art; such as small seeds, insects, salts, sands, &c. Very small pores are the interstices between the solid parts of bodies, as in stones, timbers, minerals, shells, &c. or the mouths of minute vessels in vegetables, or the pores in the skin, bones, and other parts of animals. Extreme small motions are the movements of the several parts or members of minute animals, or the motion of the fluids, contained in either animal or vegetable bodies. Under one or other of these three heads, almost every thing around us affords matter of observation, and may conduce to our amusement and instruction.

*AUGUSTA.* From what I have heard this evening, I expect to be highly entertained to-morrow, and hope, on some future day, you will favour me with more information on these subjects.

*Mr. HARCOURT.* It always affords me peculiar pleasure to communicate any thing to you, my dear

children, that may enlarge and exalt your ideas of the great first Cause, from whom every thing proceeds, and by whom every thing is arranged and governed in the most perfect order; whether we reflect on the heavenly bodies, those stupendous instances of his omnipotence; or consider the insect imperceptible by its minuteness, yet perfect in all its parts, both internal and external, we are led equally to admire and adore the same power, wisdom and goodness, that are manifested in each extreme of his works.

*Mrs. HARCOURT.* The order of the universe is an inexhaustible theme of wonder and admiration to all who consider it attentively; the wisest and most virtuous men of all ages have uniformly agreed in admiring the connection of its parts, and the correspondence of means to the end designed. Of what use would the eye have been, with all its curious mechanism, if there had been no light to render objects visible? The more extensive our knowledge of nature, the more capable we are of tracing the wisdom and intelligence, that are visible in every part of the creation.

*CHARLES.* Notwithstanding the harmony of the works of Providence is so obvious to the most superficial observer, I have heard that there have been men so perversely stupid, as to suppose, that this beautiful world, with all its various inhabitants, as well as the other parts of the universe, were produced by mere chance, or the accidental assemblage of atoms, and have refused to acknowledge the existence of one Supreme Intelligent Being.

*Mrs. HARCOURT.* If any man indeed ever doubted of that awful truth, he must have first bewildered his mind in useless and unprofitable speculations on metaphysical and abstruse subjects, beyond our limited capacities to explore, and ill suited to make us either wiser or better.

*SOPHIA.* Let such an one observe the texture of the simplest blade of grass, the gauze wing of a common fly, without extending his researches to the œconomy of either the animal or vegetable world,



and try if it can be imitated by the most exquisite specimens of art, he will find that it baffles every attempt, even in its external structure; but when he examines the internal organization and uses of the parts, he must acknowledge it to be the work of a Divine Artist.

*Mr. HARCOURT.* The various degrees of instinct in animals, and the intellectual powers in man, will be still more difficult to account for, as originating from any inferior cause, than that of an Infinitely Wise Almighty Being.

*Mrs. HARCOURT.* Natural religion, or the belief of the existence of a God, the Creator and Preserver of the Universe, for the manifestation of his power, wisdom and goodness, is not confined to the globe which we inhabit, but extends to the remotest point of created space, is so congenial to our rational nature, that it is surprising that any one ever dared to acknowledge a doubt of it.

*Mr. HARCOURT.* The united testimony of all ages and nations concurs to render such men suspected of professing a belief, which in the privacy of their own minds they deny, or of wilfully refusing to open their understandings to the convictions of truth. The most savage and ignorant tribes in every part of the globe, not only acknowledge the existence of a Supreme Cause, though they worship him under different names, and frequently mistake very absurd objects for his representatives; but also an universal belief of his divine influence upon the human mind; from this conviction arises the idea of prayer, a custom confined to no particular country, but the universal refuge of the human species in moments of distress and anguish; an assurance, that he graciously condescends to hear the petitions of his creatures, and benevolently relieves their affliction, must give encouragement to these applications.

*Mrs. HARCOURT.* If we deprive mankind of this consoling hope, our present state is a deplorable one indeed; beset with temptations, surrounded by difficulties and trials, to what power could we flee for

succour? Wretchedness with despair would be thy portion, O man! bereft of the consolation of natural religion, which not only teaches us to believe in the existence of an Almighty God, but also to adore his infinite perfections, to rely upon his goodness for preservation from the evils of the present life; and prepares us for the reception of the truths of revealed religion, by which are meant those manifestations, which have been revealed to man supernaturally by various means, but in a most especial manner by the coming of Jesus Christ, who was sent on earth to introduce a more pure and holy religion than that given to the Jews, or any that had ever been contrived by human wisdom. He might properly be called the messenger of glad tidings, offering peace and immortality to all the human race without distinction, who should embrace his doctrine; and live according to his precepts.

*Mr. HARCOURT.* The perverseness of men's dispositions, and the limited faculties we possess, whilst in our present state, will ever raise cavillers against the most clear conviction; but let us shut our ears against their conversation, and our eyes against their writings; contenting ourselves with the study of the New Testament, and relying upon the assurances the Gospel offers; convinced that this line of conduct cannot injure us, but is likely to lead us to peace and happiness.

*Mrs. HARCOURT.* The period of man's life is too short to be wasted in speculative researches, which have no influence in correcting the disposition, or amending the heart. The path of duty is plain and obvious to every one who sincerely endeavours to find it, and is equally adapted to the capacity of the unlettered hind, as to that of the learned philosopher. Each one has a part to perform, according to the circumstances in which he is placed; superior intelligence calls for superior excellence. A disposition to acknowledge the goodness of the Supreme Being; towards all the parts of his creation, and thanksgiving for the peculiar blessings bestowed on

each individual are incumbent duties on every rational creature. Let us unite in offering this incense with unfeigned gratitude, and conclude this conversation in the words of the poet :

Almighty Power, amazing are thy ways,  
Above our knowledge, and above our praise ;  
How all thy works thy excellence display !  
How fair, how wonderful are they !  
Thy hand yon wide extended heaven upraised,  
Yon wide extended heaven with stars emblaz'd,  
When each bright orb, since Time his course begun,  
Has roll'd a mighty world, or shined a sun.  
Stupendous thought ! how sinks all human race,  
A point, an atom, in the field of space.  
Yet ev'n to us, O Lord, thy care extends,  
Thy bounty feeds us, and thy power defends.  
Yet ev'n to us, as delegate of thee,  
Thou giv'st dominion over land and sea.  
Whate'er or walks on earth, or flits in air,  
Whate'er of life the watery regions bear,  
All these are ours, and for th' extensive claim,  
We owe due homage to thy sacred name.  
Almighty Power, how wondrous are thy ways !  
How far above our knowledge and our praise !

## CONVERSATION XX.

*Mrs. HARCOURT.* SOPHIA, the company has a claim upon you for the completion of your account of the porcelain manufacture, which was deferred for the sake of obliging Augusta with some information concerning the use of philosophical instruments. You have already amused us with a description of the materials, we are impatient to be informed of the manner of making them into porcelain.

*SOPHIA.* The proportion of petunse and kaolin varies according to the degree of delicacy of the texture of the ware required to be made. The best

kinds demand a greater quantity of kaolin than the coarser sorts. Kneading and tewing the two earths together is the most laborious part of the work, which operation is performed in large basons or pits, well paved and cemented, in which the workmen trample the materials with their feet, till the mass be well incorporated, and becomes of a consistence requisite for the use of the potter. When taken out of the basons, they are obliged to knead it again with their hands, after having divided it into smaller pieces. On this operation the perfection of the work depends, as the intervention of the smallest body, or the minutest vacuity, would be sufficient to spoil the whole; a grain of sand, or a single hair will sometimes cause the porcelain to crack, splinter, run, or warp.

*CECILIA.* What extreme nicety is required in the workmen, to attend to such small circumstances!

*Mr. HARCOURT.* Excellence in every art is attainable only by attention and accuracy.

*SOPHIA.* The different form of the vessels is effected, by a turning wheel, as in our potteries; but moulds are used in the formation of figures of men or animals; ornaments in relievo are also formed in moulds and finished with the chissel. This part of the work partakes more of the nature of sculpture than mere pottery, therefore several other instruments, proper to dig, smooth, polish, and touch up the strokes that escape the mould, are necessary to give the piece its utmost perfection. Pieces in relievo, such as flowers, &c. are frequently formed first, and then added to the figure they are designed to ornament, by cementing them with porcelain earth, moistened with water, and the fissure is polished with an iron spatula.

*CHARLES.* Of what material do they make the moulds suitable to this purpose?

*SOPHIA.* They are made of a yellow fat earth which is kneaded till it be sufficiently dry, fine, and mellow to be formed into the necessary shapes.

*Mrs. HARCOURT.* In the arts of design and per-

spective, the Chinese are exceedingly deficient, and must therefore yield the palm undisputed to the Europeans in these respects; as the finest tints, laid on without taste or judgment, can only produce a glaring effect upon the eye, but are insufficient to please a correct fancy. In the brilliancy of their colours they excel us; but whether this arises from the materials they use, the superiority of their varnish, or their method of burning them, I cannot decide.

*SOPHIA.* The colours applied to porcelain are the same as those used in enamel painting, and consist of metallic calces, which are the residue of metals, after calcination by fire, or solution by chemical processes. With design to form colours for painting on china or enamel, they bruise these calces, and incorporate them with a very fusible glass. Crocus of iron affords a red colour; Cassius's precipitate of gold makes the purple and violet; copper calcined by acids, and precipitated by an alkali, gives a fine green; zaffre makes the blue; earths slightly ferruginous produce a yellow; and lastly, brown and black colours are effected by calcined iron, mixed with a deep blue of zaffre. These colours are ground with gum-water, or oil of spike, to render them fit for use. I am indebted to my mother for all that I have related concerning the colours, and I hope I have repeated it without mistake. A powder or calx of gold is applied, as in the coloured enamels, for the gilding: the painted and gilded porcelains are exposed to a fire capable of fusing the glass, with which the metallic colours are mixed; by this means they adhere, and acquire a gloss equal to that of the glazing of the china. The gold receives additional brightness from burnishing it with a blood stone.

*HENRY.* Pray, sister, explain what a blood stone is.

*SOPHIA.* It is a ruddy mineral substance brought from Egypt and Ethiopia, and named from its resemblance to dry curdled blood.

*AUGUSTA.* I have often heard that poor women suffer great hardships for want of employment, especially those who have been decently brought up.

Might not painting on china be suitable work for them, as it depends more upon taste than strength?

*Mrs. HARCOURT.* Were there more opportunities of obtaining a creditable subsistence, it would preserve many unhappy females in the path of honour and virtue, who now wander forlorn and abandoned, in the ways of vice. Too many of those occupations, that are adapted to the abilities of women, are engaged by men, whose talents and bodily strength might be more properly exerted in laborious callings.

*Mr. HARCOURT.* You are pronouncing a satire upon your sex; whilst ladies of fashion patronize men-milliners, stay-makers, mantua-makers, hair-dressers, and haberdashers, without manifesting the smallest compassion or sympathy for their forlorn and destitute sisters, it cannot be matter of astonishment, that the industrious female vainly seeks employment, and is deprived of those resources to which she has a natural claim.

*CHARLES.* A lady of rank and influence, who would counteract this pernicious mode, by openly encouraging women in the different branches of trade, suitable to their powers, would deserve the imitation of her countrywomen, and the honourable appellation of a true patriot.

*CECILIA.* When I grow up, I will always employ women to make every article of my dress.

*AUGUSTA.* And I will frequent those shops only where the customers are served by women.

*Mrs. HARCOURT.* This conduct will do honour to your understandings, as well as to your hearts; but we have wandered far from the subject in hand. Sophia resume your account.

*SOPHIA.* The last operation before the porcelain is carried to the oven, is the oiling or varnishing: according to the quality of the work, the varnish is laid on more or less thick, and seldomer or oftener repeated. Much art is required in putting it on; all parts of the vessel should be equally covered, and no spot thicker than the rest, which would destroy the smoothness and polish of the surface. Two kinds of

ovens are used in baking china, large ones for works that are baked only once, and smaller ones for those that require a double baking. The ovens are composed of a mixture of three different sorts of earth. At the top of the domé, which is in the form of a tunnel, is a large aperture, to give vent to the flames and smoke, mounting up continually, as soon as the oven is once lighted. The pieces of porcelain that are baked in the large ovens, are put into cases or coffins, as they are called, made of the same materials as the ovens, to prevent any diminution of lustre, from the too violent effect of a naked fire.—Great caution is necessary in placing the pieces of porcelain in the smaller ovens, no cases being used; they are piled up pyramidically, so that no part of that which is painted in one, touches the paint in another, lest the colours should run, and destroy the beauty of the whole.

*Mr. HARCOURT.* The workhouses are properly vast yards, walled round, with sheds and conveniences for the defence of the workmen against the weather, as well as other buildings adapted to provide them with dwellings. This manufacture, like several others that have passed under our observation, employs a prodigious number of hands. Almost every piece is handled by twenty workmen, before it is ready for the painter, and by more than sixty, before it attain perfection. The painting work is distributed amongst a great number of artists in the same laboratory. One paints nothing but borders, another traces out flowers, and gives them to one of his fellow labourers to lay on the shades; waters and mountains alone employ a fourth hand, birds and other animals a fifth, whilst the human figure is reserved for the work of a particular person. There are porcelains made of all colours, both with respect to the grounds, and the representations upon them. Some are simple, consisting of one colour, as blue; others composed of a variety of tints; and others again are heightened with gold. This multiplicity of workmen is found by experience, to for-

ward rather than retard the work, not only in this, but in all manufactures where various operations are necessary. Each workman, by continual application to the same object, acquires dexterity and facility in that branch of the art, and not only performs his part more expeditiously, but better, by frequent repetition.

*CHARLES.* How few accommodations can a man possess, who lives in a state of solitude; he must be totally incapable of bringing any thing to perfection, much more the numberless conveniences required to render civilized life comfortable!

*Mr. HARCOURT.* Perhaps it is impossible for a man to subsist, any considerable time, entirely independent of his fellow creatures; those who approach the nearest to it, afford specimens of the wretched effects of the want of society, and those interests that are connected with it; ignorance and indolence mark their characters, and the superiority of intellectual capacity is sunk into the sensual wants of the brute. The principal objects that occupy the mind of a mere savage, are to provide food for present subsistence, and when he has satiated his appetite with his precarious meal, to lie down free from apprehension for the wants of the morrow.

*Mrs. HARCOURT.* The blessings that result from the mutual assistance we receive from others, and give in return, should teach us humility and kindness to every one, remembering that the proudest and the greatest would be destitute and wretched, without the good offices of many of the meanest of mankind.

*AUGUSTA.* I blush at recollecting the contempt with which I formerly treated those whom I considered as my inferiors. I owe my change of sentiments and behaviour to the instruction I have received from our evening lectures, which have taught me to know, that every worthy individual is valuable to the community.

*SOPHIA.* The formation of a common tea-cup engages a great many hands, as you will perceive,



when I have related the particulars. The potter, who has the management of the wheel, gives the cup its form, height, and diameter. A second workman fits it to its base. A third receives it from him, and applies it to a mould, to bring it to its true form. A fourth polishes the cup with a chissel, especially about the edges, and reduces it to the proper thinness. Another workman turns it upon a mould to smooth its inside; the handles, or ornaments in relievo, are added by different hands; and lastly, the foot is rounded and hollowed on the inside with a chissel, by a workman whose peculiar office it is. When arrived at this degree of maturity, it has still many operations to undergo, which require the skill of various artists. It must yet be painted, varnished, baked, and glazed.

*HENRY.* The trouble that it costs to make a teacup, will teach me to be careful how I break one.

*CECILIA.* Fire does not crack all kinds of earthen ware: Mrs. Hervey has a set of saucepans made of a peculiar kind; and, what is still more extraordinary, a stove of the same substance.

*Mr. HARCOURT.* The manufacture you speak of, is carried on at Chelsea. When we are in London, an afternoon might be pleasantly passed in observing the work. It shall be one of our first excursions.

*Mrs. HARCOURT.* Before this subject is dismissed, allow me to pay a just tribute of praise to the abilities and taste of our late countryman, Mr. Wedgwood, who has extended and applied the manufacture of stone-ware to a vast variety of curious compositions, subservient not only to the common purposes of life, but also to the arts, antiquities, history, &c. The utility and elegance of his inventions have diminished the use of foreign china, and substituted, in its stead, a ware that supplies the domestic wants of our own country; and by its excellence and cheapness, is in general esteem in most of the nations of Europe.

*AUGUSTA.* Does not enamel resemble china?

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*Mr. HARCOURT.* Charles, it is not long since we went together to Mr. Spencer's, the jeweller, to see some pieces of clockwork that were to be sent to the East Indies; if you can recollect what passed on the composition of enamel, it will form an agreeable sequel to Sophia's information.

*CHARLES.* A mixture of glass, with metallic calces, composes the substance called enamel. The general basis of the different kinds consists of an equal proportion of the finest lead and tin calcined, or burned together in a kiln, and then sifted to a powder, which is boiled in several waters, pouring off the water carefully each time; this operation is repeated as long as any part of the calx passes off with the water: the remainder is calcined again, and washed in the same manner as before. After evaporating the different waters which have been poured off from the calces, a powder of extreme fineness remains; this, with an equal quantity of crystal frit, and a small proportion of white salt of tartar, when powdered, sifted, and well mixed together, is once more exposed to the operation of fire for some hours, and being again reduced to powder, forms the material of common plain enamel, of which all others are made.

*CECILIA.* We shall not be satisfied, without you tell us in what manner it is applied, to compose the beautiful coloured enamels.

*CHARLES.* Enamels are of three kinds; the first kind is intended to imitate precious stones; the second is used in painting in enamel; and the third by enamellers, jewellers, and goldsmiths, on gold, silver, and other metals. The colours require to be very nicely ground, and mixed well together, adding a proper quantity of the matter of plain enamel: this mixture, when incorporated into one mass by the heat of a furnace, is cast into water to cool: after it is dried, it is again melted in a furnace; in this state it is usual to try the colour, which, if too strong, is weakened by adding more of the plain

matter; or, if requisite, heightened, by increasing the quantity of the coloured ingredient.

*HENRY.* Are enamels made mostly in England?

*Mr. HARCOURT.* The two first kinds are frequently made by the artists who apply them to their respective uses; but the last comes chiefly from Venice and Holland in the form of little thin cakes of different sizes, impressed with the maker's name, or some device adopted by him, as the sun, &c. Those imported from Venice are mostly white, slate-colour, sky-blue, carnation, yellow, green, and a deep blue; from these seven colours, the ingenuity of those skilled in this art forms the various tints that please the eye, in the rich workmanship that adorns our shops of jewellery. Of all these, the simple white is of the most general use; by uniting it with azure, it becomes slate-colour; the addition of copper and cyprus vitriol makes it a sky blue; that of perigelaux, a flesh colour; iron rust renders it yellow; and copper filings change it to green.

*SOPHIA.* The Dutch owe the excellence of the glazing of their porcelain to the use of this plain enamel.

*CECILIA.* My love of drawing makes me desirous of knowing the method of painting in enamel.

*Mr. HARCOURT.* Charles, I call upon you to repeat what you heard upon that subject, as I doubt not but you remember it as well as that which relates to enamel in general.

*CHARLES.* The purest gold is the best substance to work upon, because it receives all colours, and admits equally of those that are transparent or opaque: other metals are sometimes used, but they are adapted only to particular colours, or modes of laying them on. The invention of opaque or thick colours is of much later date, and is an improvement upon the transparent method: this discovery has produced many exquisite pieces of modern art, presenting portraits and events from history in as great perfection as the best paintings in oil; but with this important advantage, that they preserve their beauty and lus-

tre undiminished by the injuries of either time or weather. Before the colours are laid on, the gold plate should be covered with plain white enamel on both sides, to prevent any swelling or warping from the fire; it also serves the purpose of heightening the light tints, being left clear in those parts that require it. The plate being thus prepared, the outline is to be sketched upon it, according to the design of the piece, and placed before a fire, which is to be repeated every time the work is retouched.

*CECILIA.* Is a common fire hot enough to give the colours a gloss?

*CHARLES.* I ought to have said a reverberatory fire, which is made in a little furnace, in which the heat is confined all round the place where the piece is put. The colours, after being mixed up with oil of spike, are laid on, with great delicacy, with the tip or point of a hair pencil, as in miniature painting.

*Mrs. HARCOURT.* In the transparent manner, the colours are laid on flat, and mixed with water only. Although we owe the improvement of this art, in its present state of perfection, to the moderns, the original invention of giving colours to glass, upon which the system of enamel painting is founded, is extremely ancient. I think we read of beautiful vases, curiously enamelled with figures, being made in Tuscany, whilst Porfenna was king of that country. A later period produced many admirable specimens of the same discovery in the duchy of Urbino, enriched by the inimitable pencil of Raphael, which are still to be seen in the cabinets of the patrons of the fine arts, under the name of Raphael's ware.

*Mr. HARCOURT.* The French have the honour of having raised the art to its present height; in the year 1632, James Tantin, a goldsmith of Châteaudun, first discovered the method of using opaque colours, which preserved their lustre, after being exposed to a degree of heat sufficient to melt them, without running one into another. Many of his countrymen improved upon his labours, till the art extended to

other nations. The value of the picture, which it is applied, contains many miniatures, snuff-boxes, rings, &c.

*AUGUSTA.* I have a fine miniature which is thought a great resemblance to look at it, and tell me whether it is painted in enamel?

*Mrs. HARCOURT.* It bears a strong likeness to the features of my beloved friend, and recalls many tender emotions to my mind; but it is painted in the common manner, with water-colours on ivory.

*CECILIA.* Are miniatures always painted either in enamel, or on ivory?

*Mrs. HARCOURT.* Sometimes they are done upon vellum, or even paper; but it is necessary to strengthen the paper with isinglass size, thickened with pearl white; a coat of starch, of moderate thickness, with a little isinglass infused in it, is useful to render common paper more capable of bearing the colours. It should be laid on very smoothly with a brush, and when the paper is almost dry, it should be pressed between boards. Two sheets of paper, cemented together with this mixture, make a suitable substance for this species of painting, which consists of dots or fine strokes of the pencil. It is an elegant art, and well adapted to vary the amusements of young women, who have leisure and taste to pursue it. The capacity of representing a lively image of a flower or a bird, may be ranked amongst the higher accomplishments; but the power of delineating the human countenance is very much superior to it; particularly that branch of design which enables the artist to convey to the ivory or canvass the resemblance of an individual endeared by friendship. My dear girls, you have already attained a tolerable degree of excellence in the use of the pencil, it will be easy for you to rise higher, and adorn my closet with the likenesses of those friends that are dearest to us.

*SOPHIA.* It will give me great pleasure to learn to paint miniatures; and, I have no doubt, but that it will be equally agreeable to Augusta and my sister.

The last time you indulged us with visiting Mr. Wedgwood's warehouses, I remember to have observed some vases of black porcelain, painted after antique designs, but without any glazing; I am at a loss to know how this difference arose.

*Mrs. HARCOURT.* The ingenious and indefatigable Mr. Wedgwood, ever desirous of improving the different branches of porcelain to their utmost perfection, after many experiments, and much reflection, invented a set of encaustic colours that imitated the Etruscan vases, having beauty and durability without the defect of a varnished or glassy surface. The encaustic paintings of the ancients were done in wax, and afterwards melted before a fire. The vases you remarked were painted in this revived method.

*CHARLES.* I admire the genius and talents of Mr. Wedgwood, and think he has rendered more essential service to his country, than some of the warriors, whose tombs are in Westminster Abbey.

*Mr. HARCOURT.* He was indeed an useful member of the community, and at the same time that he improved the manufactures of his country, he enriched himself. But remark, that it was not by idle indulgence, or inattentive levity, that he attained these advantages: industry, perseverance, and talents, united to form his character, which may fairly be held forth for imitation.

*HENRY.* To what uses did the ancients apply vases? In our days they only serve for ornaments, or to hold flowers.

*Mr. HARCOURT.* They were used, in their sacrifices, to hold the incense. After burning the dead bodies of their relations, they deposited the ashes in an urn, which is a vase of a lower, flatter form, than those applied to other purposes. Before long we will repeat our visit to Mr. Wedgwood's warehouse. The collection of ornamental works affords a curious example of the various vessels in use in former ages; and whilst they increase our knowledge of the customs and domestic manners of the ancients, they contribute to establish a taste for that which is truly beautiful and elegant.

*CHARLES.* I have heard that, of late, a great deal of our common china ware has been printed with copper-plates, and that this method is far more expeditious than painting it. Before we separate, give me leave, father, to remind you of your promise of taking me to see the decoy ponds to-morrow.

*Mr. HARCOURT.* I am glad you mentioned it : in the multiplicity of my concerns, it might have passed my memory. It is now time to retire, that we may be disposed to rise early, and pursue our walk in good time. Adieu.

CONVERSATION XXI.

*CECILIA.* **T**HE only amends you can make, Charles, for depriving us of my father's company to-day, is by telling us what you saw at the decoy ponds.

*CHARLES.* The account will afford you so much diversion, that I do not fear being forgiven, for the sake of the entertainment our walk will produce.

*Mr. HARCOURT.* I am much pleased that we went, as the information we gained there will supply a subject for this evening, that, I believe, will at least have the charm of novelty to recommend it to all the company.

*AUGUSTA.* I do not even know their use or design.

*Mr. HARCOURT.* Decoys consist of different contrivances to ensnare wild fowl of various kinds, especially dun birds, widgeon, and teal. The first thing to be considered is situation. The pond, or piece of standing water, should be large and sheltered upon all sides by woods, beyond which a marsh or uncultivated heath is desirable, for the purpose of preserving the water in the most profound stillness ; for the accidental noises of a village or a high road would disturb the wild fowl, and drive them from their haunt, to which they retire, for the convenience of sleeping, during the day time, in quiet and security.

*SOPHIA.* I thought it had been peculiar to owls to sleep in the day.

*Mrs. HARCOURT.* That depends upon the habits of animals : most of the ferocious kinds are said to repose in the day, and prowl in search of prey under cover of the night. Wild fowl, after satiating themselves with food of an evening, retire to some piece of standing water, where they lie in multitudes, covering its surface, and resting themselves in a dozing state till the return of the same hour the next night, when they rise in such vast numbers, as to occasion a pleasing, melancholy sound, which may be heard at a very great distance on a still evening.

*CHARLES.* The decoy men call a flight or rising a hulk, in Somersetshire they give it the appellation of a rodding. The ducks take their flight in a very curious manner, and with such order, as to lead to a supposition, that they are either under the command of a leader, or have previously agreed upon the disposition of their company. The whole body divides into two wings, leaving a space for those which are behind to follow with greater facility ; above all, they are cautious to rise exactly against the wind.

*HENRY.* Do they catch wild fowl at all seasons ?

*Mr. HARCOURT.* They are generally taken from October to February : it is forbidden by act of parliament to catch them in this manner from the first of June to the first of October. On the approach of winter, they migrate from more northern countries into our milder climate, where the cold is seldom so intense as to freeze rivers and large pieces of water for any great space of time. The return of warm weather urges them to avoid the excess of heat, by retreating again to their former habitation.

*HENRY.* How are they instructed to know the proper time for undertaking their journey, and by what means do they find their way over the vast ocean ?

*Mrs. HARCOURT.* The All-wise Creator, when he formed the various tribes of animals, endued them with propensities adapted to their different natures, and bestowed upon each, that power, or capacity, of pursuing the best means of preservation, which we



call instinct. The influence of this quality is universal amongst every order of living creatures inferior to man ; from the mighty elephant to the most minute insect, its principle is uniform, producing a similarity of action in every individual of the same species. Whole flocks of birds are known to migrate from one country to another, in search of peculiar kinds of food, or induced by a transition of climate more congenial to their existence : but the most acute philosopher is unable to explain the sensation that teaches them the proper moment to remove, or the course that leads to the exact spot that produces the food they are seeking. Although we cannot account for the many curious facts which result from animal instinct, it is a subject which deserves our most attentive observation, supplying a never-failing source of amusement, and leading the mind to acknowledge and adore the wisdom of the Supreme Being, manifested in his works.

*Mr. HARCOURT.* Animals lose a part of the instinct they enjoy in a state of nature, by associating with man, and relying upon him for support and protection : in many instances, they shew a capacity of being taught, and acquiring artificial habits. The decoy ducks are trained to allure and seduce others into the nets prepared for their destruction.

*SOPHIA.* Surprising ! By what art is this effect produced ?

*Mr. HARCOURT.* It will be best explained, when the apparatus belonging to a decoy pond is fully described, a task which I impose upon Charles.

*CHARLES.* A piece of water, of several acres, situated in the midst of retired woods, being chosen, a number of pipes, as they are called, are formed to catch the wild fowl. These pipes consist of a ditch, or small canal, communicating with the pond, and growing narrower from the entrance to the termination ; over which is an arch of netting suspended upon hoops, closing at the end of the canal in a funnel net. As the direction of the wild fowl depends upon the wind, a pipe is provided for almost every point

of the compass. Along each pipe are placed, at certain distances, screens made of reeds, fixed in an oblique direction, so as to completely conceal the decoy man from the wild fowl, though he contrives to peep at them through small holes cut in the screens, over which he throws hemp-seed to the decoy ducks, in order to entice them to the farther part of the pipe; the hemp-seed being very light, floats upon the surface of the water, and allures the wild fowl to follow their insidious companions into the snare. The decoy ducks will frequently lead the way up the pipe at the sound of their master's whistle, and will sometimes dive under water, whilst the unwary strangers fly above, and are taken in the snare. The decoy man is often obliged to make use of a little dog, when the wild fowl happen to be in such a sleepy, dozing state that they will not follow his ducks; the dog, having been long trained to the employment, plays backwards and forward between the reed-screens, till he attracts the attention of the wild fowl; provoked at the disturbance, they advance without fear, to drive away this contemptible enemy; whilst the dog, by the command of his master, draws nearer and nearer to the end of the pipe, seducing his pursuers so far, that their return is prevented by the appearance of the fowler, who comes out from his hiding-place; nor will the nets above them suffer their escape upwards; pressed upon all sides, they rush into the purse net, and meet their fate. If the dog does not obtain a sufficient degree of attention, he is decorated with a red handkerchief, or something very shewy, which generally answers the purpose.

*Mr. HARCOURT.* The men who are employed in this occupation find it necessary to be extremely clean in their persons, and change their linen before they attend the pond, lest the effluvia of their bodies should discover them; these water fowl having such an exquisite sense of smelling, as to require the utmost caution to elude it; for the same reason, the decoy man takes his stand always upon that side of the

pipe towards which the wind blows ; or, as a sailor would express it, upon the leeward side.

*AUGUSTA.* I suppose a dog may be taught almost any thing : the tricks of the dancing dogs have frequently amused me, and raised my astonishment by their dexterity. My own little Daphne has wonderful sagacity ; she understands me whenever I speak to her, and begs so prettily when she wants a piece of ginger-bread, that I trifle away many an hour in playing with her.

*MRS. HARCOURT.* Time is too precious to be lavished in trifles, minutes are sufficient to bestow upon such an useless employment ; but I forbear to be severe in my remarks upon this honest confession, believing that you daily improve in the appropriation of your leisure. The facility with which dogs receive instruction is wonderful, and renders them very beneficial to man, by enabling him to train them properly to the pursuit of many wild creatures, which he could never obtain without their aid. The dominion given to us over the inferior orders of animals, authorises us to avail ourselves of the faculties they possess, that they may become more useful ; but the abuse of that power degenerates into tyranny, when we torment them unnecessarily. You admire the grotesque attitudes and ready obedience of those poor beasts which are led about, and compelled to amuse the unthinking spectators ; but you would commiserate their sufferings, did you know the cruel discipline they have groaned under, for the purpose of attaining these ridiculous accomplishments. A person of reflection and humanity ought to discourage the tormenting of an inoffensive horse, a harmless pig, or an innocent dog, when there is no other motive for it, but the gratification of seeing either of them pick out the letters that are called for, paw the number of the hour, or dance a hornpipe. They receive their lessons when very young, and they are enforced by deprivation of food, and the influence of the rod placed in the hands of an unfeeling master.

*AUGUSTA.* Cruelty is a vice to which I feel no

temptation. I shall never take pleasure again in seeing extraordinary feats performed by animals, which I shall suppose to have been learned at the expence of their ease and comfort.

*Mr. HARCOURT.* The dun birds are frequently taken in a different manner. It is usual for these birds to rise in vast numbers of an evening after having reposed upon the water all day. The decoy man, acquainted with the time of their taking wing, watches the proper moment, and draws a very wide net across the pond, which is supported by poles of fifty feet high; the leaders of the flight, impeded in their progress by the entanglement of the nets, fall back, and obstruct the passage of those that follow them; whilst they, in their turn, do the same to those behind them: confusion ensues; and being heavy, and unable to rise again, when once beaten down, they become an easy prey to the men, who stand on the bank of the pond, prepared to take and destroy them. Their number contributes to their destruction; seventy dozen have been taken by this means in one night: the produce of a season is almost beyond calculation.

*CECILIA.* Is this what Mr. Chadwick meant, when he spoke of driving wild fowl in the fens of Lincolnshire?

*Mr. HARCOURT.* That is practised only in the months of July and August, during the moulting season, whilst the birds are deprived of their wing feathers, which prevents them from escaping from the spaniel, which is well trained to the employment. The nets are set in creeks or narrow places, and the wild fowl being put up by the dog, and unable to fly from him, are driven immediately into them; or, sometimes, the dog seizes them, and brings them unhurt to the feet of his master. They are taken alive, and yield considerable profit to the poor inhabitants of fenny countries; though, at that time, they are lean and out of flesh, they presently become fat and well-tasted, by feeding upon liver, barley, scalded bran, &c. and are then thought by epicures to have

a higher flavour than either tame ducks bred in a farm-yard, or wild ones in their natural state.

*SOPHIA.* Has the dun bird any resemblance to the common wild duck?

*Mrs. HARCOURT.* The bird known by that name, is the *ferina pochard*, called by Ray the red-headed widgeon. It has a lead-coloured bill; the head and neck are of a bright grey colour; the breast, and part of the back, where it joins the neck, are black; the tail consists of twelve short feathers, of a deep grey; the legs are lead-coloured, and the inside of them a bright yellow, tinged with red. The head of the female is of a pale reddish brown. In the winter season, they frequent our fens, and augment the number of delicacies found in the London markets; forming an article of commerce that enriches three descriptions of persons; the decoy owner consigns them, in considerable numbers, to a wholesale trader, who retails them to the poulterers for the accommodation of his customers. During the course of the winter, especially if it prove severe, they advance pretty far to the south, being found in the neighbourhood of Grand Cairo, in Egypt. They migrate into France towards the end of October, in small flocks, from twenty to forty, and are also seen in the winter in Carolina. Their flight is rapid and strong, adapted to such long journies; but the flocks form no regular shape in flying, and they chiefly live upon small fish and shells.

*CECILIA.* The benefit arising from the wild fowl that frequent fenny countries, must tend to counterbalance the many disadvantages of living in such swampy places, where neither corn nor fruits can be expected to repay the labour of the peasant.

*SOPHIA.* Have you forgotten that every country is favoured with its peculiar treasure; that even Greenland is possessed of riches congenial to its climate and situation?

*CHARLES.* One considerable source of support to the inhabitants of fens, is the profit produced by the multitudes of tame geese which are reared there.

Mr. Chadwick says, that one person will possess one thousand breeding geese, from each of which he may depend upon bringing up seven young ones; thus his stock will be increased to eight thousand by the end of the season.

*Mr. HARCOURT.* The possessors of these flocks do not rely only upon the demand for the use of the table, but upon the feathers for their principal gain. Vast numbers, however, are sent annually to London, under the care of drovers, for the supply of the markets. The superannuated geese and ganders are got rid of, by mixing them with the others; but, as their flesh is exceedingly tough and rancid, it cannot be supposed that the purchasers of these ancestors of so many descendants will be well satisfied with their bargain. They have recourse to the barbarous method of plucking, in order to obtain the feathers, and this operation is performed five times in the year. About the latter end of March, they are plucked for feathers and quills; and they undergo the same discipline four times between that period and the latter end of September, for feathers only.

*HENRY.* Does plucking the geese in this manner give them much pain?

*Mr. HARCOURT.* The noise and resistance made by the young ones, upon this occasion, shew that the sensation is disagreeable; whilst the patient submission of those who have frequently suffered it, proves that it is not exquisitely painful. The cruelty of the custom does not consist only in giving present uneasiness; but by depriving these poor creatures of their natural defence against the cold, numbers of them perish in consequence of it, if severe weather ensue.

*CHARLES.* You will be surpris'd to hear the care that is taken of the tame geese in the fens of Lincolnshire, during the breeding season. The owner of them prepares coarse wicker pens, made of the oziars, which abound in those marshy situations, and places three rows of them, in tiers, one above another, in every apartment in his house. In these pens,

The geese sit, and hatch their broods, each bird keeping possession of its own nest, without interfering with that of another. They are regularly, every morning and evening, driven to water, by a person called a gozzard, which signifies gooseherd, whose office is to watch them, and, at their return, to replace those geese who occupy the upper stories in their proper lodges.

*SOPHIA.* Does the tame and the wild goose belong to the same species?

*Mr. HARCOURT.* They were originally the same; the influence of domestication alone has caused the tame ones to differ from the parent stock. The grey lag, or wild goose, is two feet nine inches in length, and five feet in extent. The bill is large and elevated, of a flesh colour, tinged with yellow; the head and neck ash coloured; breast and belly whitish, clouded with grey; the back grey also, and the legs of a flesh colour. This species resides in the fens the whole year, breeds there, and hatches about eight or nine at a brood, which are frequently taken, and brought up tame; their flesh is reckoned higher flavoured than that of the domestic goose. When wild, the goose lays but once in a year; good keeping will cause the tame goose to rear two broods; and if the eggs are taken away in succession, she will produce a sufficient number for three. In the management of animals, as in many other instances, art improves upon nature; the design of which is obviously to stimulate the industry and ingenuity of man. Although, towards winter, they collect in great flocks, they remain in the fens in all seasons. On the continent they are migratory, passing from one place to another in flocks of several hundreds, the whole forming a triangle, proceeding with the point foremost, and headed by a conductor, which tiring sooner than the rest, retires behind, and leaves his place to be filled by another; when they journey in small companies, they follow one another in a direct line. It is supposed that they are natives of all countries, being found in every part of the globe.

*SOPHIA.* I have heard that geese live to a great age.

*Mr. HARCOURT.* Instances are related of their attaining to eighty or a hundred years.

*AUGUSTA.* What induces the Lincolnshire goose-owners to deprive them of their feathers in so wanton a manner?

*Mrs. HARCOURT.* Interest is the inducement, as you will perceive, when I tell you, that the pens upon the table are the quills taken from the wing of that bird. Our beds and pillows are stuffed with their feathers, which require a preparation for that purpose, by drying them well in the sun, and when the juices, which would cause them to rot and putrify, are all exhausted, they are put into bags, and the dust beaten out of them with poles. Feathers form a considerable article of commerce, even between distant countries. Eider down, so much valued on account of its lightness and warmth for quilts and mattresses, is imported into England from Denmark, and grows beneath the feathers, upon the breast of those ducks, that inhabit Hudson's bay, Greenland, Iceland and Norway. Dantzic supplies us with a great quantity of cock and hen feathers. The down of the swan is brought from the same place, and from its snowy whiteness makes beautiful muffs and tippets. The ostrich feathers, used at the installation of the knights of the garter, are valued at a high price, which I suppose is caused by their scarcity: Muffs made of feathers of various kinds are beautiful; warm, and light. Sophia, can you recollect any part of the conversation that passed a few days ago upon the mechanism of feathers, and their peculiar suitability as clothing to the inhabitants of the air?

*SOPHIA.* Nothing could be contrived, so well adapted to the use for which they are designed. They form an elegant and commodious covering for birds, defending them against cold and wet; assisting them, by their warmth, to hatch their young, and protect them against the inclemencies of the weather. Their glossy smoothness promotes their passing through the air easily and uninterruptedly, being placed, with



exquisite neatness from head to tail, one folding over another, with the closest uniformity. As a preservative to this nicety, the feathered tribes, especially water fowl, are furnished with a little bag, situated near the tail, containing an oily or unctuous matter, with which they prune and dress their feathers. A soft down lies close to the body, beneath the feathers, which preserves the bird from cold: it possesses none of the compactness and strength of those on the outside, that are exposed to wind and weather.

*CECILIA.* I admire to observe the exactness of birds in dressing their feathers; a quarter of an hour spent in the aviary, has animated me frequently to greater neatness and regularity in my own person.

*Mrs. HARCOURT.* A lesson seasonably bestowed. You are too much inclined, my dear Cecilia, to be inattentive to that refined nicety, which is the best ornament of female beauty.

*SOPHIA.* The construction of the quill feathers is admirably adapted to their use; the shaft or rib is exceedingly strong, which empowers it to resist the air, but the lower part of it is hollow; and that above, but little inferior to it in strength, is filled with pith. The vanes, or webs, by which I mean those feathers that grow like fringes upon each side of the quill, are wonderfully contrived to catch hold, or clasp one another, and form an even, resisting surface, when the wing is expanded, so that not a single feather is deprived of its full force and impulse upon the air. The outward vane is narrow and bending downwards, whilst the inward one is broad and turning upwards, by which it unites with the exterior vane of the next quill, which spreads over it. The tips are all sloping, those of the interior vanes inclining to a point, towards the outer part of the wing, and the exterior vanes towards the body; so that, whether the pinion be extended or shut, the edge is as neatly sloped, and completely finished, as if trimmed constantly with a pair of scissars.

*Mrs. HARCOURT.* Here is the quill feather of a goose, take the microscope, children, and examine

the laminae, or small feathers, which compose the vanes. You will discover as much contrivance and design in each of those small parts, as in the whole feather.

*AUGUSTA.* I should have thought it a perfect feather, if I had not seen it put into the glass. One side is thin and smooth, but the other edge is divided into two rows of hairs, broad at bottom and narrow toward the top.

*CECILIA.* I see the hairs you mention very plainly; those on one side are straight, but those on the other are hooked.

*CHARLES.* Do you remark that the hooked beards are always placed next those that are straight?—I suppose that is for the purpose of bracing the laminae together.

*SOPHIA.* Had these vanes consisted of one continued membrane, an accidental injury would be irreparable, and the poor bird must remain lame, and find a difficulty in flying, till the return of the moulting season.

*HENRY.* How large it looks!—We should never know half these wonders without microscopes.

*Mr. HARCOURT.* We have been insensibly led from one thing to another, till our time is fully spent. I designed to have related to you many entertaining particulars, relative to the different methods of catching birds, but they must be deferred till a future opportunity.

*HENRY.* Pray let us hear them to-morrow night. I wish it were not too late now.

*Mr. HARCOURT.* With all my heart, I promise to resume the same subject at our next meeting. Adieu.

## CONVERSATION XXII.

*HENRY.* **M**Y mind was so taken up with the conversation last night, when I went to bed, that I dreamed of nothing but decoys and setting of traps; pray, papa, begin to tell us those con-

trivances for catching birds, which you had not time to relate.

*MR. HARCOURT.* It is with great willingness I comply with your request, since I am certain your tenderness and humanity will never permit you to avail yourself of my information, to entrap or destroy a harmless bird wantonly. All creatures are given for our use, and are subject to our power; it is therefore allowable to kill them for food, or other necessary purposes; but the boy who is capable of inflicting pain without any other motive, than that vile and debasing one, of beholding the sufferings of the poor victim, is already hardened to a degree, that prepares him for the perpetration of cruelty towards his fellow man, when arrived at manhood. Geese and ducks are caught by various means in different countries; it would be tedious to repeat every particular method, as many of them have a great similarity; but there is one, used both in the East and West-Indies, as well as in China, that is very curious; Charles is acquainted with it, and will save me the trouble of describing it.

*CHARLES.* The fowler wades into the water up to the chin, and having his head covered with the skin of a dried goard, called a calabash, approaches the ducks, which, unmindful of this object, suffer him to mix among them, when he takes as many as he pleases, with the greatest facility, by drawing them by the legs under the water. This method is often practised on the river Ganges, substituting the earthen vessels of the Gentoos instead of calabashes: these vessels are what the Gentoos boil their rice in, and are called Kutcharee pots; when once they have been used, they look upon them as defiled, and throw them into the river, where they are picked up for the purpose I have mentioned.

*MRS. HARCOURT.* The Chinese prefer tame ducks to wild ones; and, it is said, hatch great numbers by artificial heat; the eggs being laid in boxes of sand, are placed upon a brick hearth, to which is given a proper heat during the time required for hatching.

them. The ducklings are fed with the flesh of crawfish and crabs, chopped small and mixed with boiled rice; in about a fortnight, they are put under the care of an old duck, which teaches them to provide for themselves, being first habituated to a sampane, or boat, from which the whole flock, often to the number of three or four hundred, thus brought up, go out to feed, and return at command. About the time of cutting the rice, and reaping the crop, these duck sampans are commonly seen rowing up and down the river, according to the opportunity of procuring food, which is found plentifully when the tide ebbs on the rice plantations, which are overflowed at high water. It is surprising to see thousands of ducks, belonging to different boats, feeding upon the same spot promiscuously, return at a certain signal to their respective sampans, without a single stranger being found amongst them.

*AUGUSTA.* Charles mentioned the Gentoos; as I do not know the meaning of the term, I request he will explain it.

*CHARLES.* They are a people who inhabit the country of Hindostan, in the East-Indies, and profess the religion of the Bramins.

*MR. HARCOURT.* You do right, Augusta, to let nothing pass, which you do not understand, without asking for an explanation. The catching of small birds, in the neighbourhood of London, is a trade followed by weavers, and other mechanics, who, during the months of March and October, exchange the close confinement of garrets for a range in the open fields, where they subsist, for a time, upon the profits of this employment. The nets they use are made to correspond exactly with each other, and are generally twelve yards long, and two and an half wide; they are constructed so as to flap over one another with such velocity, as seldom to disappoint their owner of his prize, when the pullers are drawn. But all this apparatus would be ineffectual without the assistance of birds to allure and seduce the wild ones into those very snares in which they themselves were once

caught. The emulation for superiority of song; which excites the vocal tribes to vie with each other, is the mean used to ensnare them. The nets being properly laid, and singing birds, in small cages, placed near them, the flur birds are braced by a silken string, tied under their wings round their bodies, and by that confined to a moveable perch fixed within the nets. The office of these birds is to call others to a contest with them for excellence; upon the first perception of the approach of the wild birds, one of them gives notice to the rest, which produces the same tumultuous joy and ecstasy among them, as is heard in a pack of hounds upon discovering the scent. The invitation is given by what is called jerks, in the language of the bird catchers, and is so loud and powerful as to stop the wild birds in their flight, and fascinate them to the very verge of the machinery prepared for their destruction. Artificial means are used to cause these call-birds to moult before the natural season, which renders their song more powerful than that of others; but the process is cruel, and many die under it, which enhances the value of the survivors to a surprising height: four or five guineas have been given for a single song bird. The hens of every species are killed, and sold by the dozen for the use of the table; but the cocks are generally preserved for the sake of their song.

*Mrs. HARCOURT.* The system adopted by the London bird-catchers is ingenious; but the hazardous contrivances, to which the inhabitants of the Orkney and Feroe Islands are compelled by necessity, are wonderful.

*HENRY.* Pray, relate them.

*Mrs. HARCOURT.* The Orkney Isles lie to the north of Scotland; multitudes of the inhabitants subsist upon the eggs of the birds which build upon the cliffs of the rocks, during the breeding season: but this precarious support is obtained at the utmost hazard of their lives. The dauntless fowlers will ascend the cliffs, which are of a tremendous height, and pass from one to another with amazing dexterity. Some-

times they are lowered from above by a rope, made either with straw, or the bristles of a hog, which they prefer even to ropes of hemp, because it is not so liable to be cut by the sharpness of the rocks. One man, who stands upon the edge of the precipice, lets down his companion, and holds the rope, depending on his strength alone, which often fails, and the adventurer is dashed to pieces, or perishes in the sea.

*SOPHIA.* The very recital makes me shudder.

*Mrs. HARCOURT.* The Holm of Nofs is a vast rock, severed by some unknown convulsion of nature, from the island, about sixteen fathoms distant. It is of the same stupendous height as the opposite precipice, with a raging sea between: several stakes have been fixed on the top of the corresponding cliffs, by some bold and fortunate adventurer, who must have attained the heights by extraordinary dexterity; a rope is fastened to these stakes on both sides, along which a machine, called a cradle, is contrived to slide; and, by the help of a small parallel cord, the daring fowler wafts himself across, and returns with his booty.

*Mr. HARCOURT.* Courage depends much, as to its kind, upon habit and education; the brave general of a vast army would appear a coward amongst these hardy islanders.

*Mrs. HARCOURT.* The cliffs of the Feroe Islands, which lie in the Northern Ocean, and are subject to Denmark, are extremely high, and greatly frequented by sea-fowl; the eggs, feathers, and flesh of these birds are the inducements which tempt the natives to explore the recesses of these vast precipices, both from above and below. When they purpose descending, they are furnished with a rope eighty or an hundred fathoms in length. The fowler fastens one end of this line about his waist and between his legs, recommends himself to the protection of the Almighty, and is lowered down by six others, who place a piece of timber on the margin of the rock, to preserve the rope from wearing against the sharp edge. Their dexterity in this dangerous employment is almost incredible to those who have never been inured to face such difficulties: They

will place their feet against the front of the precipice, and dart some fathoms from it, with a cool eye survey the places where the birds nestle, and again shoot into their haunts. Sometimes the fowler will spring from the rock, and with a fowling-net, placed at the end of a staff, catch the old birds as they fly towards their nests. When the dreadful task is finished, he makes a signal to his friends above, by means of a small line, fastened to him for that purpose, and they pull him up, and share the hard-earned profit. The feathers are preserved for exportation; the flesh is partly eaten fresh, but the greater portion is dried for winter provision.

*CECILIA.* To what variety of hardships are we strangers, from the fortunate situation in which we are placed!

*Mrs. HARCOURT.* At other times they begin their operations from below; the party set out in a boat, and proceed to the base of the precipice which they design to ascend, when the person, who is to climb the rock, fastens a rope about his waist, and takes with him a pole, with an iron hook fixed at one end of it, to assist him in his progress. Thus equipped, he climbs, or is thrust up by his companions, to the first spot where he can gain a firm footing. Here he lowers his rope, and brings up one of the boat's crew; others are hauled up in the same manner, and each is furnished with a rope and fowling-staff. Their progress to the higher regions is continued by the same means: when arrived to the heights where the birds frequent, they act in pairs; one of them fastens himself to his associate's rope, and is let down to the haunts of the birds beneath him; but when the strength of the man above is unequal to the task of drawing him up again, he is overpowered, and both inevitably perish. The boat attends, and receives the booty. These expeditions often last several days: the nights they pass in the crannies of the rocks.

*SOPHIA.* Nothing can be more applicable to the present subject, than some lines I read a few days ago written by Shakespeare.

How fearful

And dizzy 'tis, to cast one's eye so low !  
 The crows and choughs, that wing the midway air,  
 Shew scarce so gross as beetles : half way down  
 Hangs one that gathers samphire—dreadful trade !  
 Methinks he seems no bigger than his head :  
 The fishermen, that walk upon the beech,  
 Appear like mice ; and yon tall anchoring bark,  
 Diminished to her cock ; her cock, a buoy  
 Almost too small for sight : the murmuring surge,  
 That on the unnumber'd idle pebbles chafes,  
 Cannot be heard so high :—I'll look no more ;  
 Lest my brain turn, and the deficient sight  
 Topple down headlong.

*CHARLES.* The treasures of the hawk's nest are obtained by men let down from the summits of rocks by a single rope.

*CECILIA.* Do you call such rapacious birds treasures ?—I can perceive no use in taking them, they have neither voice nor gentleness to recommend them.

*Mr. HARCOURT.* They are less valued now than formerly, when hawking was in fashion ; but there was a time when a good hawk, of the Norwegian breed, was esteemed a present worthy of a monarch. The diversion of hawking, which consists in the art of taking different species of wild fowl by means of trained hawks, is very ancient, especially in Thrace and Britain. The love of this amusement prevailed among the ancient Britons, and descended to later times. The English nobility were devoted to it ; a nobleman seldom appeared abroad without his hawk upon his hand ; and the force of their example influenced their inferiors, all ranks partook of it in a degree ; but the enormous expence that attended it, confined it principally to the great. In the reign of James the First, Sir Thomas Monson is said to have given one thousand pounds for a cast of hawks. Rigorous laws were imposed for the preservation of an exclusive right to this diversion ; as far back as the reign of Edward the Third, it was made felony to steal a hawk and im-



prisonment for a year and a day, to take the eggs, even upon a man's own ground: in these arbitrary times, the poor were exposed to capital punishments, loss of liberty, and fines, for no greater crime than destroying a rapacious bird of prey; whilst the higher orders of society, who are bound by their rank to give good examples, spent the day in the ferocious sports of the field, and the night in the most licentious profligacy and depraved sottishness.

*CHARLES.* The picture you have drawn of our ancestors, places the elegant refinement of modern dissipation in the light of a step towards moral improvement.

*Mrs. HARCOURT.* Our vices are not so brutal as formerly, but they still are vices, and by wearing a more seductive appearance, are perhaps more dangerous. Pictures throw a light upon the manners and customs of the times in which they were painted. I have seen a picture of Harold, who contended for the crown of England with William the Conqueror, embarking on an embassy into Normandy, with a hawk upon his hand, and a dog under his arm.

*Mr. HARCOURT.* The peregrine falcon inhabits the rocks of Caernarvonshire. The same species, with the gyr falcon, the gentil, and the goshawk are found in Scotland, and the latter in Ireland. The name falcon is confined to the female, which is fiercer, stronger, and more courageous than the male. The art of training hawks for this exercise is a science, possessing terms peculiar to itself, the minutiae of which is only valuable to falconers, and those who are inclined to pursue the sport, which is now almost out of date in this country.

*SOPHIA.* Birds are a class of animals peculiarly engaging; their vocal powers, the beauty of their form and plumage render them pleasing; but their most interesting property is the agreement of their endowments and habits with their several natures.

*Mrs. HARCOURT.* I am pleased with your observation. Give us some instances of the agreement you mention.

*SOPHIA.* Birds of prey, which feed wholly upon other creatures, are not only fierce and savage in disposition, but are furnished with bills hooked at the end, for tearing their victims, and with strong legs, and hooked sharp claws to enable them to hold it with a firmer gripe. The bills of crows are straight and strong for picking : in water fowl, that live upon fish, they are long and pointed, for striking ; in others slender and blunt, for searching in the mire ; and those of the goose and duck tribe are flat and broad, for gobbling. Those birds, that have long legs, have generally a long neck, or it would be impossible for them to reach their food from the ground. The power of retracting, bending, or stretching out the neck is possessed in an eminent degree by birds in general ; and among other advantages that result from it that of poising themselves in an exact equilibrium is none of the least. There are a few birds whose wings are too short to enable them to fly ; as the ostrich, cassowary, penguin, &c. but they assist the former in running, and the latter in swimming or diving, serving them as fins. The tail is used as a guide or rudder, to direct their course through the air ; for, as the head turns one way, the tail is inclined to the opposite direction. It also poises their long necks and preserves an even balance. Their peculiar ability to sustain themselves, and pursue long journies through so thin an element as the air, is said to be assisted by a power they enjoy, of enlarging their bulk when they have occasion. This admirable contrivance is effected by air vessels, dispersed over various parts of the body, even to the bones, and communicating with the lungs. As these vessels are filled or emptied, the body is contracted or dilated, and consequently rendered heavier or lighter, as the inclination of the bird requires. Many similar observations might be added, but at this moment I do not recollect them.

*CHARLES.* (It is one of my greatest amusements to observe the flight of different birds ; they have each a distinct character, and are endued with different

powers of swiftness ; were it otherwise, the weaker must always inevitably yield to the rapacity of the strong and voracious. Many are preserved by flitting from place to place with a restless agility, that the larger kinds cannot imitate ; those which live upon the water, secure themselves by diving. Kites and hawks glide smoothly along ; woodpeckers fly awkwardly and by jerks, as if in danger of sinking ; but above all, I admire the elegant swiftness and agility of the swallow tribe ; they seem as if they could live always upon the wing.

*CECILIA.* Brother, you are skilled in distinguishing the nests of different birds, favour us with some account of the most curious kinds.

*CHARLES.* They are all curious, and adapted with wonderful sagacity to the habits and wants of each instinctive architect. The study of nests has indeed formed one of my most agreeable relaxations ; but I am proud to boast, that I have never robbed one of those anxious mothers of her treasures, or disturbed her in the fond office of rearing her young. The larger rapacious kinds make their nests of sticks and bents, but line them with something soft. Most of them chuse solitary places for their residence, such as high rocks, ruined towers, &c. a few of them build upon the ground. Parrots, and all birds with two toes forward and two behind, lay their eggs in holes of trees. Crows build in trees. The nest of the magpie, though composed of rude materials, is made with exquisite art, covered with thorns, like defensive armour, and only a small hole left for an entrance. The ostrich is celebrated for neglecting her young ; she lays her eggs upon the sand, and abandons them to chance. The mode and place of building among small birds vary ; some build in bushes, others in holes of walls, or upon banks, and some upon the ground. Swallows make a curious nest, different from any other. Clay, moistened with water, is the material they use. The Chinese eat the nests of one of this species, which are formed of a glutinous matter, and esteem it a great delicacy. Web-footed fowl:

breed on the ground. Ducks strip the down from their own breasts to prepare a soft-bed for their young. In very hot climates, where monkeys and serpents abound, many birds use a wonderful precaution to secure their young from their treacherous attacks; they build a pendulous nest hanging at the end of a bough, too slender to support their dreaded enemies.

*CECILIA.* The taylor bird, a native of the East Indies, makes a very extraordinary nest of that kind; she picks up a dead leaf, and sews it to the side of one growing upon a tree; her slender bill is the needle, and some fine fibres her thread. When she has formed this external coat, she lines it with feathers, gossamer, and down; this fragile habitation is proportioned to its tenant. She is but three inches long, and weighs only three sixteenths of an ounce.

*Mrs. HARCOURT.* Before we separate, I wish to draw your attention to the *force of habit*, which, when applied to dexterity, activity, and courage, seems capable of overcoming the very propensities and powers of nature; as is exemplified in the suspension of the breath amongst divers, who can remain a long time under water; the agility of the climbers of rocks exceeds any powers that persons unaccustomed to the exercise are acquainted with; and various other employments call forth faculties and capacities that would for ever remain dormant, unless excited by necessity, and confirmed by habit. Let us, each one, vigorously apply this principle to the practice of virtue, and the subjection of every improper inclination and propensity, and we may rationally hope, in time, to attain to an advanced degree of moral perfection. Adieu, dear children.

### CONVERSATION XXIII.

*CECILIA.* **A**S I was paying my daily visit to my bees this morning, and watching their motions, I thought that entertainment might be derived from some particulars relative to the order

and discipline by which they are regulated, not inferior to that we enjoyed in the recital of the qualities of birds.

*Mr. HARCOURT.* Could we pursue the peculiarities of instinct, through all its variations, in the different orders of animals, it would supply us with an inexhaustible source of admiration and instruction; but as many of them are placed beyond the reach of our observation, we must content ourselves with the investigation of those that are obvious to our notice, among which the bee has ever been distinguished.

*Mrs. HARCOURT.* The history of the bee deserves our attention; for, although almost every country housewife furnishes her cottage garden with hives, yet the wonderful instincts that guide this small insect, are known only to the observers of nature. Cecilia has spent much of her leisure in observing the economy of those that I have put under her management, and is qualified, by experience, as well as reading, to give us information upon the subject. We have examined together the structure of the parts of the bee in the microscope. An exact description of them will shew their conformity with the purposes for which they are designed; therefore, my dear, begin your account with them.

*CECILIA.* The honey bee, for there are many kinds, is divided into three parts, consisting of the head, the breast, and the belly, which are united by two ligaments. The eyes are black, and of an oblong form, guarded by a horny tunicle or covering. The horns, mostly called antennæ, are placed between the eyes, near the middle of the head, and assist the insect in feeling his way, where the eyes are useless, for want of light. The jaws open sideways, and, being armed with teeth, serve to remove every thing offensive or inconvenient that is found in the hive. In their wars with each other, they use their teeth, and the wounds they inflict with them are supposed to be fatal. Their long trunk, or proboscis, is of very curious construction; it enables them to penetrate the inside of flowers, and extract their deli-

cious juice ; it is long and taper, and so pliant and flexible, that it can be contracted and folded up at pleasure. Four strong scales are contrived to preserve this valuable member from injury two of which form a sheath to it, whilst the whole is inclosed in the larger pair. From the breast, which is of a dusky colour and oblong form, proceed two wings, and three legs on each side. The belly is divided into six rings, or folds, which, by sliding over one another, serve to shorten or lengthen the body. Besides the intestines, it contains a bag, which is used as a receptacle for the honey they collect. The juices of flowers are conveyed into this bag from the proboscis, through a narrow pipe, which passes the head and breast. The legs are finished, in every part, with the greatest nicety ; the hindermost ones are hairy, and streaked crosswise on the inside. Within the thigh of the working bee is a hollow place, edged with hair, where the bee loads the materials for wax in little pellets, as large as a pepper-corn. Each foot terminates in two hooks, with the points opposite to each other ; between these claws is a little, thin substance, which, when unfolded, enables the insect to fasten to glass, or any other highly-polished body. The sting is situated at the extremity of the belly, and is composed of two bearded darts, inclosed in a horny sheath, which has an opening near the end, for the passage of the darts ; at the root of the sting is placed a small bag, filled with a venomous liquor, which is emitted through the sheath into the wound made previously by the darts. Mr. Derham, who is celebrated for curious microscopical observations, relates, that he counted eight beards, like those of fish-hooks, upon each dart in the sting of a wasp ; and the same number may be seen, with good glasses, in that of a bee. One of these darts is rather longer than the other, and pierces the flesh first ; the other follows instantly. They penetrate deeper and deeper, alternately, with their beards or hooks, till the whole sting is buried in the flesh, and then the insertion of the poisonous juice finishes the process. If the per-

son, who is stung, has presence of mind to remain still, the bee instinctively draws the beards close to the sides of the darts, and the sting comes out whole; but if the insect is disturbed, and attempts to withdraw the sting hastily, the beards prevent its return, and it is generally left in the wound, which increases the pain, and retards the cure.

*HENRY.* I was stung severely last summer, which makes me run away whenever I hear a bee or a wasp buzz near me.

*Mrs. HARCOURT.* It would be wiser to remain quietly without changing your posture. There is scarcely any danger to be apprehended from them, even were you surrounded by a whole swarm, unless you excite their resentment, by moving or buffeting them.

*AUGUSTA.* Why do you particularize the working bees; are there more kinds than one in the same hive?

*CECILIA.* The working bees form the great body of the hive, which is always governed by a sovereign queen, of whom I shall give you a particular description presently. She has also another kind of subjects, called drones, which differ considerably from the labourers.

*AUGUSTA.* I have frequently amused myself with looking at bees, as they were flying from one flower to another, but I never observed any distinction between them.

*Mrs. HARCOURT.* The want of accurate observation is the general source of ignorance. Exert all your diligence, children, to acquire the habit of seeing every thing with an attentive eye. Common objects are mostly regarded with indifference by the thoughtless and ill-educated; and had not philosophers bestowed a patient investigation upon many things esteemed trivial and insignificant, some of the most useful and curious discoveries in natural history must have remained unknown. Now, Cecilia, to satisfy our impatience, acquaint us with the offices and dignity of her humming majesty.

*CECILIA.* The body of the queen bee is longer and larger than that of the rest of the swarm. As she seldom leaves the hive, except for the purpose of settling a new colony, she has but little occasion for dexterity in flying; her wings are indeed but ill adapted to that exercise, being short, and scarcely reaching beyond the middle of her body, the hinder part of which is more taper, and terminates sharper than the bodies of the other bees. The under part of her belly and her legs are of a brilliant gold colour. She is the mother of the hive, as well as its sovereign, and is followed, wherever she goes, with the most dutiful obedience, by her children and subjects. A hive cannot subsist without a queen, as she is the only female which produces eggs; nor do they ever permit more than one of them to remain alive in the same hive. If she happens to find a rival, they fight till one is killed, being armed with a powerful sting, which she seldom uses, except in contests for empire, or when unusually provoked. The queen bee is very prolific, laying several thousand eggs every season: she generally lies concealed in the most secret part of the hive, and is never visible, but when she deposits her eggs in those combs which are exposed to view. She is always attended by ten or a dozen of the common bees, which form a kind of retinue; these courtiers follow their mistress with a solemn pace, in her progress from one cell to another. She examines, with care, the cell where she intends to leave an egg, lest there should be honey, wax, or any embryo in it. If she find it empty, she fixes a small white egg to the bottom of it, which is composed of a thin membrane, or skin, filled with a whitish liquor. Should the queen inadvertently lay more than one egg in the same cell, her attendants, the working bees, remove the supernumerary one. When a queen dies accidentally, the whole community desists from its accustomed labour, consumes the store of honey, and its members fly about their own hive, and others that are near them, at those hours when they should be at rest; they pine away with



grief, and mourn her loss by a clear and uninterrupted humming, which should be a token to their owner, either to take the remainder of the honey, or to find them a new sovereign; at the sight of whom joy returns, and her presence animates the whole hive to fresh exertions of industry and activity.

*MR. HARCOURT.* Charles, I think you are acquainted with the secret which enabled Mr. Wildman to astonish every body, by the extraordinary feats he performed with bees.

*CHARLES.* The facility with which he managed them appeared like magic. He found the means of making a swarm alight, just where he pleased, in a few moments. Sometimes he commanded them to settle upon his head, or to form a beard upon his chin, hanging one by another: then he would order them to remove to his hand, or any other part of his body; or, if more agreeable to the company, he would place them upon the window, table, &c. They seemed to be completely under his control.

*HENRY.* How was that possible? Bees cannot understand our language.

*CHARLES.* He made use of words only to deceive the spectators; the magical wand which he used, to transfer them from place to place, was the queen bee. He placed all his dependence upon their fidelity and attachment to her; for he knew, that wherever she was carried, the swarm would certainly follow. Repeated experiments taught him, that after turning up a hive, and tapping it upon the sides and the bottom, the queen immediately appeared, to know the cause of the alarm, but soon retired again among her people. By seeing her frequently, he learned to distinguish her at the first glance, and practice enabled him to lay hold of her so tenderly as not to endanger her person: having thus secured the queen, he slipped her gently into his left hand, without injuring her, or enraging her to sting him. Then he replaced the hive, and retained her as his prisoner, till she was missed by the bees, who, as soon as they perceived their loss, took wing with the greatest con-

fusion; whilst they were seeking their beloved sovereign, he placed her upon the spot he wished them to settle. The moment she was discovered by a few, they gave notice to the rest, till the joyful news was communicated to the whole tribe, upon which they all assembled round her, and remained a long while in that situation, as if afraid of being deprived of her again.

*SOPHIA.* This ascendancy over them must have appeared unaccountable, before the principle was known by which it was obtained; but Mr. White, in his History of Selborne, mentions an idiot boy, that lived in that village, who acquired an equal command over them, without any knowledge to guide him in his pursuit. He shewed no understanding upon other subjects, and during the winter season he would doze away the chief part of his time in the chimney corner; but as soon as warm weather returned, he resumed his only diversion, which was searching for bees in the fields, or upon sunny banks. He would catch them with his bare hands, without fear of their stings; then he would disarm them of their weapons, and suck their bodies for the sake of their honey-bags; nay, so far would he carry his temerity, that he would sometimes fill his bosom, between his shirt and his skin, with a number of them. He would slide into gardens where bees were kept, and, sitting down before the stools, would rap with his fingers upon the hives, and so take the bees as they came out. He has been known to overturn hives for the sake of the honey, of which he was immoderately fond; and, as if his imagination was impressed by this one object, he had a habit of imitating the buzzing of bees with his lips, as he ran about the fields and gardens.

*MR. HARCOURT.* This account is very extraordinary, the circumstance seems to have arisen from one of those natural propensities, which we are unable to explain.

*AUGUSTA.* My curiosity relative to the queen is pretty well satisfied; I long to know, now, what offices are assigned to the drones.

*CECILIA.* The common drones, though smaller than the queen, are larger than the working bees; and in flying make a greater noise; they have no sting, neither are their proboscis or feet adapted for collecting wax and honey. They are the males, and are found in the hives only at certain periods of the year. Economy impels the working bees to destroy the drones at the approach of winter; they do not even suffer an egg or a maggot of that kind to escape, but exterminate the whole race, as useless, after the season for increasing the young stock is past, and they begin to provide a magazine, to supply the swarm with food during the cold weather, when no fresh honey can be procured. The working bees are the most numerous part of the state; they have the care of the hive, collect the honey and wax, make and work up the wax, build the cells, feed the young, keep the hive clean, defend it from intruders, and perform every thing necessary to be done for the benefit of the commonwealth. As the labourers are the guardians of the hive, the sting is a requisite weapon for them to resist the attacks of their enemies; for there are many lazy, greedy insects, which will attempt to devour them, as well as their honey.

*HENRY.* You said, that the working bees destroyed the maggots of the drones; do bees undergo the same changes as silk-worms?

*CECILIA.* On the third or fourth day after the egg is laid, a worm or maggot is produced, which, when it is grown so large as to touch the opposite corner of the cell, coils itself up into the shape of a semicircle, and floats in a liquid, which sustains it, and promotes its growth. The working bees are very attentive in supplying the worms with a sufficient quantity of this liquor, which is conjectured, by some naturalists, to be a mixture of water with the juices of plants and flowers, collected purposely for the nourishment of the young, whilst in that helpless, tender state. The working bees continue to feed the worm for about eight days, till one end touches the other in the form of a ring; when it begins to feel

the first posture uneasy, it ceases to eat, and unrolls itself by degrees, thrusting that end forward towards the mouth of the cell, which is to be the head. The task of the attendant bees is now changed from that of feeding the worm, to fastening up the top of the cell with a lid of wax, and cherishing the brood, and advancing the approaching transformation by their natural heat. In this concealment, the worm prepares a web of silk in the manner of the silk-worm. This web forms a lining to the cell, and affords a convenient covering for the change of the worm into a nymph or chrysalis. In the space of eighteen or twenty days, the change is effected, and the bee endeavours to extricate itself from its dark and narrow prison, by forcing its way with its teeth through the lid of the cell. One horn appears first, then the head, and, at last, the whole body. This expansion to life and liberty is sometimes the work of half a day. The bee, when released from its fetters, stands upon the surface of the comb, till it has acquired its natural complexion, and a degree of vigour and maturity to enable it to labour. The rest of the bees gather round it in this state, celebrate its birth, and feed it with honey out of their own mouths. The shell of the chrysalis, and the scattered pieces of wax, which are left in the cell, are removed by the working bees; and the receptacle is no sooner cleared from the relics of its former inhabitant, and ready to receive another, but the queen again deposits an egg in it. The hair, which covers the bodies of the young bees, being whitish, causes them to have the appearance of a grey colour; but they gradually lose that hue, and become brown.

*Mrs. HARCOURT.* As the eggs, which are destined to become drones, are to produce larger insects than those of the common bees, so they are laid in cells of more extensive dimensions, and their coverings are raised convex, like a small dome, whilst the others are flat roofed. Those cells, which are intended for the reception of the royal maggots, are built upon a very different model to any of the rest; they

are of a longish oblong form, having one end bigger than the other, with their outward surface full of little cavities. They are sometimes fixed in the middle, and at other times in the side of a comb. Several common cells are sacrificed to form a foundation and support to it. As soon as the young queen comes out of her cell, it is destroyed, and the vacancy filled up with common cells; but, as the base remains, the comb is found thicker in that part than in any other. There are apartments prepared in every hive for the rearing of several queens, lest, by any accident, they should be deprived of their sovereign mistress, and have none to replace her. When the members of the commonwealth are become too numerous for the extent of their city, by the addition of the young brood, a part of them, conducted by one of the young queens, leaves the parent state, and seeks a more convenient situation elsewhere. A new swarm is always composed of a queen, several thousand working bees, among which there is a mixture of old and young, and some hundreds of drones. The moment the colony has chosen a new residence, the labourers begin to work with the utmost diligence, to procure materials for food and building. Apparently conscious that their queen is ready to lay her eggs, they are more anxious to provide cells for her progeny, than for storing of honey. Such is their industry, that they will form combs twenty inches in length, and proportionably wide, in the space of a night and a day. If the weather is favourable, they make more wax during the first fortnight, than in all the rest of the season.

*CHARLES.* The community of bees does not excel in the arts of peace only, it is skilled in the destructive science of war. I have seen whole hives engaged in a pitched battle, when one state has been, by some circumstance, plundered of its honied store, hunger and necessity have compelled its members to seek a fresh supply in a neighbouring hive, from which they have been vigorously driven away by its owners. Great skill is observable in these contests,

in the manner of pointing the sting between the scaly rings of their adversaries bodies; but it often happens that the conqueror gains the victory at the price of his life, for if he leave the sting in the wound, part of his bowels follows it, and certain death is the consequence.

*AUGUSTA.* The construction of the combs must be very curious; I long to hear a minute description of the inside of the hive, and the method used by the bees in working.

*Mrs. HARCOURT.* Our subject has far exceeded the limits I expected; many things, relative to this interesting topic, remain to be explained; but the evening is far advanced, and Cecilia must resume her information to-morrow night. Adieu, my beloved children.

#### CONVERSATION XXIV.

*Mrs. HARCOURT.* **W**E are assembled earlier than usual, which is rather fortunate, as I conjecture we shall find sufficient matter for a long conversation.

*AUGUSTA.* However late it may continue, I shall not think it tedious; the particulars I have already heard, only excite me to wish to hear more concerning the bees. I shall not be satisfied till I possess some of my own, and examine the reality of what Cecilia has told me. I shall depend upon her assistance to teach me how to manage them.

*CECILIA.* The little knowledge I have, you will be welcome to; and it will give me great pleasure to be your associate in this scheme, the plan of which we will arrange hereafter. A hive of bees may, with propriety, be compared to a well-peopled city, in which are commonly found from fifteen to eighteen thousand inhabitants, subsisting under the most perfect discipline of wise laws. The regulation of labour among them is very exact. They are divided into

four companies, one of which roves in the fields in search of materials for building; another is employed in laying out the bases and partitions of their cells; a third is occupied in polishing and smoothing the insides of them; and the fourth company brings food for the rest, or relieves those which return oppressed with their burdens. But the same bees are not confined constantly to the same labour. Their tasks are frequently changed. Those which have been engaged in the hive are indulged in making excursions abroad, whilst those which have enjoyed the wholesome freshness of the air, submit, without reluctance, to confinement within. They appear either to have a language of their own, or to understand one another by signs. When one of them is in want of food, it bends down its trunk to the bee, from whom it expects assistance, whilst this last opens its honey-bag, and suffers some drops to fall for the needy one, which stands ready to receive it. So admirably is the work distributed, and so great is their diligence, that in the space of a day, they are able to build apartments, sufficiently numerous to contain three thousand inhabitants.

*SOPHIA.* The advantage of order and regular arrangement is shewn in the policy of this small insect. Were the bees guided by no rule, instead of providing for the accommodation of such numerous inhabitants, confusion must perplex their designs, and they would interrupt one another in the progress of their work, like the builders of the Tower of Babel.

*Mrs. HAKCOURT.* Their sagacity in constructing and distributing their cells is equally admirable. In their manner of building, the bees have attained three essential points aimed at by all good architects; the two first of which are, the greatest possible economy of room and materials; and the last is to procure all the accommodation that can be obtained in the space allowed for the edifice. The form of their cells is a hexagon, or figure of six equal sides. If you examine it, you will see, that the circumference of one cell makes part of the circumference of those adjoin-

ing to it, which is a saving of the wax, as well as the space, none of which can be lost, where there is no void between the apartments. The third advantage will be more difficult to your comprehension, as it depends upon mathematical knowledge; but those who are skilled in that science, tell us, that the hexagon affords more space than any other figure that can be joined together. Their frugality induces them to make the partition very thin; but they strengthen the entrance of the cells, which are most liable to be injured, by a fillet of wax quite round them, which makes them three or four times thicker than the sides; and the bottom is supported by the junction of three cells exactly beneath the middle of it; for they are careful to place them in such a manner, that the middle of the bases of one row is directly opposite to the angles of the next to it. The combs lie parallel to each other, and there is left between every one of them a space which serves as a street, broad enough for two bees to pass by each other. There are also holes which go quite through the combs, and may be compared to lanes, for them to pass from one comb to another, without being obliged to go a great way about.

*HENRY.* I should like to watch a hive of bees from the laying their foundations, to the completion of the comb.

*CÆCILIA.* That would not be easy to accomplish, for notwithstanding glass hives and other contrivances have been used with that design, there are such numbers in continual motion, and they change their places so quickly, that it appears only a scene of confusion. Some of them, however, have been observed to carry pieces of wax in their talons to the place where the others are at work upon the combs, which they fasten to the work with their feet. Others have been seen running about, and beating the work with their wings and their tails, perhaps for the purpose of hardening it and making it stronger. Whilst some of the bees are busied in building and forming the cells, others are employed in polishing those already



made : the smallest roughness is taken off with their talons. They continue patiently at this task, till they have completed it, never leaving off, except to carry away the particles of wax they scrape off, which others receive from them, and employ in raising other parts of the edifice.

*HENRY.* Since I have heard so many curious things about the bees, I have spent all my play time near Cecilia's hives, and yesterday I saw several bees loaded with little balls of yellow wax sticking to the hollow place in their thighs.

*CECILIA.* The balls, which you observed, are not wax, but a powder collected from the stamina of flowers, many of which abound with it ; in the lily it is very visible, as you must have often experienced, if ever you have pulled any of them to pieces.

*HENRY.* O yes, I know what you mean ; my fingers have been covered with it sometimes.

*CECILIA.* This powder, or pollen, as it is properly called, does not become wax till it has undergone a process in the stomach of the bee. In collecting this substance, which is the material that composes the comb, the bee enters into the cups of flowers, particularly such as afford the greatest quantity of it. As the insect's body is covered with hair, it presently gathers a good deal of this dust, by rolling itself within the flower ; this it brushes off with its hind legs, and kneads it into balls, which it pushes into those two hollow places I mentioned before. In this pursuit, the bee flies from flower to flower, till it has accumulated as much as it can carry, and then returns home with its treasure. Upon its arrival at the hive, it frequently happens that three or four other bees assist in relieving it of its burden, by each eating a share of the cargo. It is not a desire of food that urges them to swallow this substance, but an earnestness to provide a supply of real wax for making the combs. At other times, when there is no immediate want of wax, they lay it up in repositories, to serve for the supply of future occasions. After having swallowed it for some time, they have a

method of returning it, when they want it for use, and it is only when in this soft and pliant state, that they can apply it properly in the making of combs. It is supposed, by the quantities they collect, that a great deal of it is laid up for food. In this state it is known by the name of bee-bread.

*Mrs. HARCOURT.* The crude wax, by which I mean the material which they swallow to make wax, is not always yellow, but varies according to the flowers from which it is gathered. The combs are at first white, but are changed to yellow, by the steam and impurities arising from so many insects confined in one place. Honey, which is their principal treasure, is originally a juice digested in plants, which exudes through their pores, and exists chiefly in their flowers, or in reservoirs, called honey-cups, of various forms, and differently situated in different flowers. The bees obtain the honey, either by penetrating into these recesses, or they collect it when exposed upon the surface of the flower. This precious spoil is carried home in their stomachs; so that, though heavily laden, they appear, to a superficial observer, as if they had procured nothing by their excursion. Bees are equally fond of another substance, called honey-dew, of which there are two kinds, both being produced upon vegetables, though arising from different causes. The first kind, which is commonly supposed to be a dew, that falls upon trees, is nothing but a mild, sweet juice, which, having circulated through the vessels of vegetables, is separated in reservoirs in the flowers, or on the leaves, where it is properly called the honey-dew. Sometimes it resides in the pith, as in the sugar-cane; and at others in the juice of pulpy summer fruits, when ripe. Manna, which is found on the ash and maple trees of Calabria, issuing from their leaves and trunks, is a species of honey-dew. The second kind is produced by a small insect, and supplies the bees with a resource, when the spring flowers are gone, and the dew, which transpires from the plants is no longer to be obtained.

*CECILIA.* There is yet another substance collected and used by bees, but I cannot say, with any certainty, where they procure it; some suppose, that they meet with it on the birch, the willow, and the poplar. It is a resinous gum of a more gluey quality than wax, and different from it in many respects. The use to which they apply it, is to plaster the inside of their hives, and to fill up the most minute crannies, that may chance to be in them. It was called by the ancients propolis. When they begin to work with it, it is soft, but in length of time acquires a brown colour, and becomes much harder than wax.

*AUGUSTA.* Do not the bees lay up a store of honey against the winter season?

*CECILIA.* As soon as they reach the hive with a load of honey, they deposit it in an empty cell. They have two sorts of store-houses, one is filled only with honey, that is intended for the supply of accidental wants; the other contains their winter store, which they are careful to preserve, by several sagacious precautions. There is, in each cell, a thicker substance, something like a cream, which is placed over the honey, to prevent it from running out; this gradually rises as the cell is filled; when it reaches the top, the bees close up the cell with a covering of wax, and it remains untouched, till necessity compels them to have recourse to it.

*CHARLES.* It is wonderful to see them hang by one another in a heap or cluster, when they settle in a swarm. I cannot think how the bees, from which the others suspend themselves, can bear so great a weight.

*CECILIA.* When a swarm divides into two clusters, it is a sure proof that there are two queens among them, one of which must be destroyed before they will unite and settle quietly. Their instinct is as admirable in providing for their own safety and well-being in some other respects, as in those I have already remarked. They defend the hives from the intrusion of other insects, by gluing up every avenue by which they might gain an entrance; and sentinels are appointed to watch the mouth of the hive,

to prevent the admission of a stranger; but if a snail, or other large insect, should, by any means elude their vigilance, they sting it to death, and incrust it with a coat of propolis, to prevent maggots, or a disagreeable smell issuing from the putrefaction of so large an animal. It is conjectured, that bees are sensible of the approach of bad weather. You may sometimes see them, though ever so busy at work, suddenly desist from their labour, and return home in such crowds, that the door of their habitation cannot admit them. Look at the sky, and you will perceive the cause of all this bustle, in the gathering of small clouds that foretel rain. It is said, that no bee is ever caught even in a sudden shower, unless at a great distance from home, or in a sick or disabled state. They crowd together in the middle of the hive, in order to protect themselves against the effect of cold, which is very injurious to them. Upon every occasion, they appear to be endued with a sagacity superior to most other insects, of whose economy we are informed.

*CHARLES.* I think there are several species of bees; can you favour us with particulars relative to any of the rest.

*CECILIA.* Linnæus enumerates fifty-five; some of which live in society, whilst others dwell and labour in solitude, building cradles for the reception of their infant progeny; as the leaf-cutter bee does with the leaf of the rose-tree; the upholsterer, with the gaudy tapestry of the corn-rose; the mason-bee with a plaster; and the wood-piercer with saw-dust. Various are their modes of building, as well as the materials they use, according to their different instincts, and the climates they inhabit. The honey-bee, which has taken up so much of our attention, is, in some degree, domesticated, and its manners differ from those in a wild state, as hives are provided by man for it to build its comb in.

*Mrs. HARCOURT.* The management of bees is an art, which would take up too much of our time to define, but some observations relative to it, will serve to illustrate what has already been said. The first

care is to chuse a situation for the apiary, that is neither too much exposed to the rays of the sun, or to the cold. A supply of food is the next consideration, which greatly depends upon the abundance of those plants in the neighbourhood which yield honey in plenty. Thyme, heath, and broom are thought excellent for the purpose, as well as many others which I shall pass over. As some situations are deficient in this respect, at certain seasons, contrivances have been used, in countries where bees form an essential branch of agricultural economy, to remove them from one place to another. In many parts of France, it is not unusual to see floating bee-houses. They will put from sixty to a hundred hives on board one barge, well defended from the injuries that might be occasioned by an accidental storm. By this conveyance, they float gently down the river, feeding on the flowery pastures on its banks; and, by the honey they collect during the voyage, repay their owner for the trouble of removing them.

*Mr. HARCOURT.* Pliny relates a similar custom among the ancients. The Egyptians also avail themselves of the advantage of difference of climate, between Upper and Lower Egypt. The productions of spring are full six weeks forwarder in Upper Egypt, which induces the bee owners of the lower division to embark their hives on the Nile, at the proper season for reaping the benefit of the advanced state of vegetation in that country, and to bring them back time enough to collect the rich produce of the fields in their own neighbourhood.

*CHARLES.* This is one, among numberless instances, of the improvement that animals receive, from living under the government of man. This well-chosen change of situation affords them an opportunity of making a much larger quantity of honey, than they could possibly do if left to themselves.

*Mrs. HARCOURT.* Consistently with that wisdom, which shines forth in every part of creation, insects that feed upon leaves, flowers, and green succulent plants, are generally in a torpid, inactive state, dur-

ing the winter, when they cannot provide themselves a subsistence abroad. Though bees are pretty much in this state, and eat little, whilst cold weather lasts, yet, if their honey is taken away, they require to be supplied with a sufficiency for their support, or they must inevitably perish.

*SOPHIA.* It appears to me, the height of ingratitude and cruelty to destroy the bees, when we rob them of their treasure.

*Mrs. HARCOURT.* It is a common practice to destroy these industrious, useful insects, when their hives are plundered, by digging a hole near them, and putting a stick into the hole, at the end of which is fastened a rag, that has been dipped in melted brimstone, the rag is set on fire, the hive is placed over it, and the earth is immediately thrown up all around, so that none of the smoke escapes. In a quarter of an hour all the poor bees appear to be dead, and are soon irrecoverably so, by being buried in the earth, that is returned back into the hole.

*AUGUSTA.* This is a sad requital for all their labour and ingenuity.

*Mrs. HARCOURT.* Many ingenious persons have applied their talents to the invention of schemes to prevent this cruelty. The most elegant and successful that I have seen, is effected by placing a flat, round board, perforated with holes, sufficiently large for the bees to pass easily through, over the hive : upon this board stands a glass, formed a little like a flower-pot, smallest at bottom, and expanding at top ; this may be covered by another board, to serve as a foundation for a second glass ; additional stories, in like manner, diminishing in size till they form a pyramid, may likewise be raised to what height the owner pleases. When the bees have filled their hive, they continue to work upwards, filling not only the glass hives, rising one above another, but also small bell glasses, placed over holes made at the edges of the boards, till they are all stored with wax and honey ; which is obtained by removing these glasses when full, and placing empty ones in

their stead ; the bees, finding room and employment for the young swarms, remain in their habitation, without attempting to colonize. This apparatus is expensive, and for that reason can be adopted only by persons of fortune ; but wooden hives, constructed upon a similar principle, will probably, in time, come into general use, as they will be found to unite profit with convenience.

*SOPHIA.* I read a wonderful account, a little while ago, in the Philosophical Transactions, of a bird, found in the interior parts of Africa, called the indicator, or honey guide, which directs travellers to the spot where honey is to be found. It is a species of cuckow, but much smaller than that which frequents Europe. Honey being its favourite food, it is prompted by self interest to point out the place where the booty is concealed, as it is generally repaid for its intelligence, by a part of the spoil. The morning and the evening are the times in which it searches for food, and it is then heard calling, in a shrill tone, cherr, cherr ; a note which immediately draws the attention of the honey-hunters, as they consider it a signal for the chase. From time to time they answer with a soft whistle, which the bird hearing, continues its note. As soon as it perceives the men, it flutters gradually to the place where the bees are situated, continually repeating its former call of cherr, cherr : nay, if it should happen to have advanced considerably before the hunters, who are very liable to be impeded by bushes, rivers, &c. it returns to them again, and redoubles its note, as if to stimulate them to more activity. At last the bird is observed to hover for a few moments over a particular spot, and then to retire silently to a neighbouring bush, or resting place, and the hunters are sure of finding the bee's nest in that identical spot ; whether it be in a tree, or in the crevice of a rock ; or (as is commonly the case) in the earth. Whilst the hunters are busy in taking the honey, the bird is seen looking on attentively to what is going forward, and waiting for its share of the spoil ; the bee-hunters never fail to

leave a small portion for their conductor, but commonly take care not to give him sufficient to satisfy his hunger, but only a taste, that may incite him to seek for another nest.

*Mr. HARCOURT.* The instinct of this cuckoo is admirable, and properly introduced. Wax and honey are the productions which invite men to plunder the stores of the bees. Wax forms a very considerable article of commerce, the quantity of it consumed in the different parts of Europe being almost incredible. There are two kinds of it, used for different purposes, white and yellow; the first is bleached by art, the last is as it comes from the hive. After the honey is taken out of the comb, the remaining matter is put into a kettle, with a sufficient quantity of water, then it is melted over a moderate fire, and strained through a linen cloth, by means of a press; the scum is taken off before it is cold, and it is poured into moulds made of wood, earthen-ware, or metal. The bleaching of wax, or rendering it white, is performed by spreading it into very thin cakes, and exposing them on linen cloths to the air, both night and day, for the dew is as effectual in whitening it as the sun. When they are perfectly blanched by this exposure, they are melted for the last time, and cast, with a ladle, upon a table, covered over with little round dents, or cavities, of the size and form of the cakes of white wax sold in the apothecaries' shops. This wax is used for candles, torches, tapers, flambeaux, figures, and other wax works. It is also an ingredient necessary in incaustic paintings. Plasters, cerates, and salves acquire a consistency by being mixed with it; and, in some cases, it is administered internally.

*Mrs. HARCOURT.* The basket of wax fruit, which stands upon the top of my cabinet, has deceived and disappointed many. As Sophia composed it, she will please to inform us what means she used to imitate nature so closely.

*SOPHIA.* I buried the fruit I designed to copy half way in clay, and oiled its edges, as well as the half



that remained uncovered. Then I threw plaster of Paris over it as quickly as I could, making a thick coat; when this hardens, half the mould is formed; the other half may be obtained in the same manner. After I had finished my moulds, I joined them together, and poured a little melted coloured wax into them, through a hole, which I made for that purpose, and then shook it about till the inside was lined with the wax. I imagine wax dolls are made in a manner something similar.

*Mrs. HARCOURT.* A very pleasant liquor, called mead, is made from honey. It is needless to tell you the most common application of honey. If you retire into the next room, you will find supper prepared for you; and, among other things, part of a honey-comb, the produce of one of my bell-glasses, on the table, that you may be gratified with the delicious taste of that substance, which costs the bees so much labour and pains to procure. Adieu.

## CONVERSATION XXV.

*AUGUSTA.* **T**O-MORROW will be my birth-day; and as my papa is pleased to express an approbation of my behaviour, during the last twelvemonth, he has allowed me the indulgence of giving an entertainment to several of my young friends, among whom, I hope you, madam, will permit me to expect these constant companions of my pleasures and studies.

*Mrs. HARCOURT.* They shall accept your invitation with my free consent; I think there is no occasion to ask for their own, their countenances express their approbation.

*AUGUSTA.* I have already received a present from my aunt upon the occasion; it is a cabinet of medals of the kings of England, from William the Conqueror, to his present majesty.

*Mrs. HARCOURT.* I hope you will set a proper value upon this mark of her affection, and acquaint

yourself with the characters and history of these monarchs.

*CÉCILIA.* I have not a clear idea of the distinction between medals and coin which passes for money.

*Mr. HARCOURT.* Medals, though once current as money, among the ancients, are no longer so in the present times; some medals have never been used for the purpose of money, but have been struck upon some particular occasion, either to perpetuate the memory of an illustrious action, or to transmit to posterity the portrait of a great man, as a far more durable means of preserving his resemblance, than a painting on canvass. The ease with which a likeness may be multiplied, by an impression on metal, is no small advantage in favour of medals.

*Mrs. HARCOURT.* The study of medals contributes to illustrate many other branches of knowledge. It is not long since Sophia and Charles were present at a lecture upon this subject; I hope they both retain what they heard at that time. Charles, point out those sciences which medals are calculated to enlighten.

*CHARLES.* There are few studies of more importance to history, than that of medals. The evidence upon which the veracity of an historian must rest, is such corroborating testimony as is manifest to every body, and cannot be falsified. Public memoirs, instructions to ambassadors, and other state papers, confirm the veracity of modern history: such memorials are, however, liable to accidents, and by remaining generally in the countries where they were first published, are incapable of giving that universal satisfaction, that should authenticate genuine history. Public buildings, inscriptions, and statues, are more durable monuments; but these are generally obliged, from the nature of things, to remain in particular countries, so that medals alone have the qualities of giving infallible testimony to truth, of possessing the capacity of being diffused over all countries, and of remaining through the latest ages; ascertaining dates, and arranging the order of events. Geography sometimes receives light from medals, their inscrip-

tions frequently pointing out the situation of towns, or their vicinity to some celebrated river or mountain.

*Mr. HARCOURT.* Medals are also useful to determine whether the ancients were acquainted with certain animals: those which were struck on the celebration of the secular games, present the figures of various animals. On many of the Greek medals are representations of several uncommon plants, as well as animals: those of Tyre, in particular, preserve the form of the shell-fish, from which the famous purple was procured. The architect receives advantage from the study of medals, by the exact delineation of many noble edifices, that no longer exist, which are seen upon some of them. It is easy to comprehend their general use, upon many subjects connected with a knowledge of ancient events and times. As means of obtaining greater perfection in other branches of science, they are valuable; but if collected merely as objects of curiosity, they lose much of their importance.

*CECILIA.* I should never have suspected that they were capable of effecting so many useful purposes, if they had not been pointed out to me.

*Mrs. HARCOURT.* Charles has detailed the uses of this study with great exactness. But give me leave to suggest an addition, of which, I think, the historic painter may avail himself, by giving the true resemblance of the countenances of those personages, whom he represents in his pictures. It frequently happens, that the figures on medals are allegorical; some of the emblems on Roman medals are particularly beautiful. Sophia, shall I impose too hard a task upon you, to ask you to repeat those you heard described?

*SOPHIA.* I will endeavour to recal them to my memory. Happiness has sometimes the Caduceus, or wand of Mercury, which was thought to procure whatever was desired. In a gold coin of Severus, she has the heads of poppies, to express, that the greatest bliss consists in the forgetfulness of misfortune. Hope is represented as a sprightly girl walking quickly, and looking straight forward. With

her left hand she holds up her garments, that they may not impede her pace. Whilst in her right hand she displays the bud of a flower, as an emblem of future good. Abundance is imaged as a sedate matron, scattering fruits out of a cornucopia. Security stands leaning upon a pillar, by which it signifies her being free from all designs or pursuits: the posture in which she appears, corresponds with her name. A ship sailing before a prosperous breeze, was the symbol of national happiness. Much taste and ingenuity are displayed in several others, but I am not able to recollect them.

*Mrs. HARCOURT.* It was not unusual to personify the provinces of the Roman empire on medals, as well as their principal rivers. There is one colonial medal of Augustus and Agrippa, so remarkable for the display of poetical imagery, that I cannot resist giving you a description of it. The conquest of Africa is represented, on the reverse, by the metaphor of a crocodile, an animal then supposed to be peculiar to that country, which is chained to a palm-tree, at once a native of the country, and symbolic of victory.

*CHARLES.* Before this subject is dismissed, permit me to express the pride I felt, at being shewn several of the earliest imperial medals, upon which my native island was represented as a woman sitting upon a globe, with a labarum, which was an emblem of military power, in her hand, and the ocean rolling under her feet.

*Mr. HARCOURT.* May her influence in future be exerted in promoting peace and useful knowledge in Europe, and her superiority in naval strength be no longer the means of destruction to the human species; she will then be entitled to be figured under symbols more intrinsically valuable.

*HENRY.* Had I an opportunity of choosing a cabinet of medals, I should prefer those which were the most beautiful, to the largest, even if they were of gold.

*Mr. HARCOURT.* You would shew your taste,

more than your judgment in this choice. Scarcity is the quality that stamps a value upon medals; for connoisseurs, or people who understand the science, totally disregard their size, or the richness of the metal which composes them.

*Mrs. HARCOURT.* With design to multiply the impressions of those that are scarce, many ingenious contrivances have been used to take them off. Sophia, repeat that simple easy method with isinglass, which may be practised by any of you, with very little trouble.

*SOPHIA.* Melt a little isinglass glue, made with brandy, and pour it thinly over the medal, so as to cover its whole surface; let it remain for a day or two, till it is thoroughly dry and hardened; and when it is taken off, it will be fine, clear, and hard as horn, and will give a very elegant impression of the medal or coin.

*Mr. HARCOURT.* I call upon you, Henry, to name the different coins in gold, silver, and copper, that are now commonly current as money in Great-Britain.

*HENRY.* In gold, we have guineas and half guineas; in silver, crowns, half crowns, shillings, and sixpences; and in copper, halfpence and farthings.

*Mr. HARCOURT.* Very well answered. Money is the general name for that medium which the inhabitants of different nations have agreed to receive in exchange for commodities; and is an invention so ancient, that the commencement of its use cannot be ascertained. When mankind spread over the face of the earth, and were no longer one family, they were obliged to exchange their possessions, in order that each one should obtain a share of the necessaries of life. An example will explain the inconvenience that resulted from this plan. I will suppose that three persons, A. B. and C. lived in the same neighbourhood. A. possessed an ox, but was in great want of a garment. B. had a coat to spare, but was without a house, nor did he know how to build one. C. understood the construction of such houses as were

then in use, and stood in need of both food and cloathing. These three persons met, to endeavour to settle a bargain, but found it impracticable to satisfy the wants of each other by exchange. A. offered his ox to B. for his coat, but he refused it, because C. would not exert his talent in building, unless he could obtain cloathing as well as food. Charles, tell me by what means this difficulty would have been settled.

*CHARLES.* Money would have rendered it easy; A. in that case, might have sold his ox, and purchased B.'s coat with part of the price, whilst B. might have recompensed the ingenuity and industry of C. with a sum that would have enabled him to buy food and raiment.

*Mr. HARCOURT.* Although several nations of Asia, Africa, and America, make use of shells and fruits as small money to this day, yet it is reasonable to conclude, that as soon as metals were discovered, they were generally applied to this purpose, from their superiority in the qualities of firmness, neatness, and durability.

*Mrs. HARCOURT.* In rude ages, the money they used was consistent with their manners, rough and unpolished, both as to the material and the form. It is supposed, that when metal was first employed as an instrument of barter, that those who intended to purchase goods, carried a mass of it with them to the place of sale, and provided themselves with instruments to cut off a sufficient quantity for their purpose; but they soon felt the necessity of having the pieces ready cut and weighed. As society advanced, fraud obliged the different governments, or rulers of the states, to affix their stamp upon these pieces of metal, to shew that they were genuine. Among other substances used for money in very ancient time, was stamped leather; and, in later periods, necessity has driven civilized nations to have recourse to substitutes of very inferior value. The Hollanders coined great quantities of pasteboard, in the year 1574. Iron bars, quenched with vinegar, served the Lacedemonians for money, and our ancestors, the ancient Britons, used plates and rings, made either of iron or tin.

*CECILIA.* Were coins always of a circular form?

*Mr. HARCOURT.* Their form, as well as the impressions upon them, varies in different countries. In Spain they have coins of an irregular figure. In some parts of the Indies they are square, and in others of a globular form. The shekel of the Jews was stamped on one side with the golden pot that held the manna, and on the other with Aaron's rod. The Dardans stamped two cocks fighting. The Athenian coins were marked with an owl or an ox. Those of Ægina with a tortoise. The Romans sometimes impressed theirs with the image of persons who had been eminent; but this compliment was never extended to the living, till after the fall of the commonwealth, when flattery induced them to stamp their coin on one side with the head of the reigning emperor, and since that time the custom has become universal among civilized nations, that of the Turks and other Mahometans excepted; who, on account of their disapprobation of images, inscribe only the name of their prince, with the year of the transmigration of Mahomet, their prophet.

*AUGUSTA.* How long has our money borne its present form?

*Mrs. HARCOURT.* Guineas were first coined in King Charles the Second's reign, and had their name from the gold, of which they were made, being brought from that part of Africa called Guinea. The first coinage of shillings was made by Henry the Seventh, in 1503. Halfpence and farthings were formerly struck in silver by Edward the First, in 1280. The coinage of gold was not generally adopted by the states of Europe before the year 1320, when it was introduced into England by Edward the Third.

*CHARLES.* I suppose the discovery of the American continent contributed greatly to increase the gold and silver coin circulated in Europe.

*Mr. HARCOURT.* The profusion of the precious metals that flowed into Europe from the mines of South-America, reduced their value, and rendered a greater quantity of them requisite to purchase the

necessaries of life. Had the Europeans received no other advantages from this discovery, it might have been questioned, whether it had not produced more evil than good. Agriculture, manufactures, and commerce, form the true riches of nations; these are promoted by a due proportion of gold and silver, used as a medium in barter; but corn and wool, and other commodities, are the real sources of wealth to a community.

*HENRY.* Since nothing can be purchased without money, I wonder why poor people do not learn the art of making it, especially when they are in great distress, and want every thing to make them comfortable.

*Mr. HARCOURT.* It is a capital crime to counterfeit the coin of the realm. The privilege of coining is one of the royal prerogatives; but if an individual, who possesses a mass of either gold or silver, has an inclination to convert it into money, he may take it to the Tower, where the British coinage is now wholly performed, and it will be returned to him in coin, weight for weight, without incurring any expences. Charles, as I lately carried you to the Mint, which is the office for coining, I expect you will entertain us with a recital of the manner in which this art is performed.

*CHARLES.* After they have taken the laminæ, or plates of metal, out of the mould into which they are cast, they make them pass and repass between the several rollers of the laminating engine, which by being brought gradually closer to each other, give the plates an even and exact thickness. The workman then makes use of a steel instrument called a trepan; it is hollow, and of a roundish figure, with sharp edges, to cut out as many planchets or circular pieces of metal as the plate contains. In order to prepare these planchets for receiving the designed impression, they are compared with standard pieces, to see that they are of a proper weight; then the superfluous part of the metal is filed or scraped off; and lastly, they are boiled and made clean, before they



are conveyed to the machine for marking them upon the edge. The principal pieces of this machine are two laminæ, or thin plates of steel, about a line thick. One half of the inscription is engrâved on the thickness of one of the laminæ, and the other half on the thickness of the other. These sheets of steel, or laminæ, as they are called, are straight, although the planchets to be marked with them are circular. One of these laminæ is fixed tight with screws, whilst the other slides by means of a dented wheel. When they stamp a planchet, it is placed between the laminæ in such a manner, that the edge of the planchet may touch the two laminæ on each side, and that each of them, as well as the planchet, lies flat upon a copper plate, which is fastened upon a very thick wooden table. The sliding laminæ causes the planchet to turn so, that the edge receives the impression, when it has made one turn. Crown and half-crown pieces, only, are thick enough to bear inscriptions on their edges. The coining engine, or mill, puts the finishing stroke to the piece. This machine is so commodious, that a single man may stamp twenty thousand planchets in one day. Gold, silver, and copper, are all of them coined with a mill, to which the coining squares, commonly called dies are fastened; that of the face beneath, in a square box fastened with screws, and the reverse above; in a little box fixed in a similar manner, the planchet is fixed upon the square of the effigy, so as to receive an impression on both sides, in the twinkling of an eye, by turning the mill once round. Thus completed, the coin undergoes an examination of the mint-wardens, who are officers appointed for that purpose, and then is ushered into circulation. I fear my account is scarcely clear enough to be understood, but it is the plainest I can give you, unless you could see the machine.

*CECILIA.* I comprehend it very well.

*Mrs. HARCOURT.* The same process is observed in the coining of medals, but with this difference, that money, requiring but a small relievo, is perfected at a single stroke of the engine; but for medals, it is o-

bliged to be repeated several times for the sake of heightening the relieve; between each stroke the planchet is taken out from between the dies, heated, and returned again, sometimes fifteen or twenty times. Medallions, and medals of a high relieve, are frequently cast first in sand, because of the difficulty of giving them a full impress in the mill, where they are put only to receive a delicate finishing, which the sand seldom gives them.

*Mr. HARCOURT.* Until the reign of King William the Third, the British coin was made in a different manner, hammers being used instead of the mill. The method then adopted was less commodious, not so expeditious, and in every respect inferior to that now in use. The perfection of this art has been reserved for Mr. Boulton of Soho, near Birmingham, where he has constructed a most ingenious apparatus, at a large expence, capable of performing all the different operations of coining, as Sophia, who has seen it, will explain more particularly.

*SOPHIA.* The whole machinery is moved by an improved steam-engine, which rolls the copper for halfpence finer than copper has ever been rolled for the purpose of making money; it works both the couplets, or screw-presses, for cutting out the circular pieces of copper, and coins both the faces and edges of the money at the same time, with such superior excellence and cheapness of workmanship, as must prevent every attempt to imitate the coin in a clandestine manner; and consequently may prove a means of saving the lives of many unhappy persons from the hand of the executioner. By this machinery four boys of twelve years old, are capable of striking thirty thousand guineas in an hour, and the machine itself keeps an unerring account of the number of pieces which are struck.

*CHARLES.* Ought not the invention of a machine of such important use, to entitle Mr. Boulton to the honours of nobility? Titles can never be so nobly bestowed as in the reward of merit, and what merit can claim so large a recompence as that which rescues our fellow citizens from destruction?

*Mrs. HARCOURT.* Merit was the original claim to distinction of rank, but in the present refined state of society, nobility is become hereditary, and ceases to be considered as the reward of personal virtue. Should Mr. Boulton live to see his machine adopted by government, and be a witness of its beneficial effects, the reflection of having conferred a lasting advantage upon his country, must be the greatest of all rewards. The time for repose is at hand, let each one retire with a mind disposed to humble gratitude, for the blessings enjoyed in the past day. Adieu.

CONVERSATION XXVI.

*CECILIA.* **O**UR conversation upon coins has led me to consider, that I am extremely ignorant of the nature and properties of metals. I wish I may be indulged with hearing something relative to them this evening.

*Mrs. HARCOURT.* The subject you have chosen is extensive, and is combined with many branches of the arts; but I am willing to oblige you, as far as our time will allow. I suppose you are acquainted with the names of the metals.

*CECILIA.* Gold, silver, copper, iron, tin, and lead.

*Mr. HARCOURT.* Gold is the most valuable, therefore we will begin with it. The qualities which give it this superiority, are purity, ductility, heaviness, and beauty, in which it excels all others. It possesses in common with other metals, the properties of being fused or melted by fire, and of distending or spreading out under the hammer.

*SOPHIA.* I have heard that gold is the heaviest of all bodies.

*Mr. HARCOURT.* It was believed to be so, till the discovery of a metallic substance called platina, which is as ponderous as gold itself. Gold is more than nineteen times as heavy as its own bulk of water; silver nearly eleven times; copper between eight and nine times; iron something more than seven, and

less than eight times; lead eleven; and tin but seven. By comparing gold with the rest, you will be enabled to judge of its superior weight. The next quality I shall remark in this valuable metal, is the cohesion of the particles which compose it; so firmly do they adhere to each other, that it is extremely difficult to separate them. A wire of gold, one tenth of an inch in diameter, will support a weight of five hundred pounds without breaking. From this property arises another, which is its ductility, or capacity of being beaten, pressed, drawn, or stretched out to a surprising degree of thinness.

*AUGUSTA.* Is not the leaf gold, we used to buy for gilding of pictures, beaten thus?

*Mr. HARCOURT.* Yes; the expansion of the metal in that process is almost beyond imagination. M. Reaumur asserts, that in an experiment he made, that one grain of gold was extended to rather more than forty-two square inches of leaf gold; and that an ounce of gold, which, in form of a cube, is not half an inch either high, broad, or long, is beat under the hammer into a surface of one hundred and forty-six and a half square feet.

*HENRY.* How astonishing! Do tell us how this wonderful operation is performed?

*Mr. HARCOURT.* A block of black marble, of several hundred pounds weight, with a square surface, about nine inches each way, fixed into a wooden frame, serves for a table to beat the gold upon. Three of its sides are guarded by a high ledge, and the front, which is open, has a leather flap fastened to it, this the gold-beater uses as an apron to preserve the fragments of gold that fall off. For this purpose, the purest gold is melted in a crucible into ingots, or pieces of six or eight inches long, and three quarters of an inch wide. This bar of gold is made red hot, and forged on an anvil into a long plate, which is farther extended, by being passed repeatedly between polished steel rollers, till it becomes a riband as thin as paper. This is divided into equal pieces, which are again forged till they are an inch

Square: these squares are interlaid with leaves of vellum, three or four inches square: both are confined tight with cases of parchment placed in contrary directions. The whole is then beaten with the heaviest hammer, till the gold is stretched to the extent of the vellum. In this state, the sheets of gold are then taken out, and cut in four with a steel knife. These pieces are now intersected with leaves of the fine skin of an ox-gut, properly prepared, five inches square. They are again beaten till they are extended to the size of the pieces of skin; the same operations of dividing and beating are repeated the third time. Nothing remains to finish the process, but cutting the edges even with a machine adapted to the purpose, and fixing the leaves of gold in books, the paper of which is well smoothed, and rubbed with red bole, that it may not stick to them.

*SOPHIA.* I suppose the gold-beater's skin, which is used for healing cuts and scratches, is the same which you mention to be prepared from the gut of an ox.

*MR. HARCOURT.* You conjecture rightly.

*MRS. HARCOURT.* Although the distention of gold is so great under the hammer, it is vastly exceeded by the art of the wire-drawer.

*AUGUSTA.* I should have thought that impossible.

*MRS. HARCOURT.* There are gold leaves not thicker in some parts than the three hundred and sixty-thousandth part of an inch; but that is inconsiderable when compared with the extreme thinness of gold spun for laces and embroidery. Gold thread is only silver wire gilt, or covered with gold. An ingot of silver, usually about thirty pounds weight, is rounded into a cylinder, or roll, about an inch and a half in diameter, and twenty-two inches long. Two ounces of gold leaf are sufficient to cover this cylinder; sometimes it is effected with little more than one. But this thin coat of gold must be yet vastly thinner. The ingot is repeatedly drawn through the holes of several irons, each smaller than the other, till it be finer than a hair; every new hole diminishes its thickness; but what it loses in circumference it gains in

length, and consequently increases in surface : yet the gold still covers it, it follows the silver in all its extension, and never leaves the minutest part bare, not even to the microscope. How inconceivably must it be attenuated, when the ingot of silver is drawn into a thread, the size of which is nine thousand times less than it was at first.

*CÆCILIA.* This almost exceeds credibility.

*Mrs. HARCOURT.* As inconceivable as it appears, the ingot is not yet extended to its full length. The greatest part of our gold thread is spun, or wound on silk ; and, before they spin it, they flatten it, by passing it between two rolls, or wheels of exceedingly well polished steel, which operation lengthens it one-seventh, and, of course, diminishes its thickness, as well as increases the extension of the gold, which covers it, to such an exquisite thinness that M. Reaumur calculates, that it is reduced to less than the three millionth part of an inch !

*SOPHIA.* Imagination can scarcely follow such nice calculations. The fineness of the spider's webs, with which we were amused some time ago, is the only thing that I know of, that bears any comparison with it. „ Glass, I think possesses a capacity also of being drawn into threads. I remember to have been shewn what they call spun glass, when I was at the glass-house ; it resembled a skein of fine silk, and formed a pretty ornament for a head-dress.

*Mrs. HARCOURT.* Several other substances possess a degree of ductility, but very inferior to that of gold. Gums, glues, resins, and some other bodies, may when softened by water, be drawn into threads. Silver we have just proved to be ductile ; the rest of the metals have this property more or less. Gold undergoes the operation of fire without the smallest diminution. Platina and silver are the only metals besides, which do not lose their metallic appearance, and either evaporate in flame, or change into an earthy or glassy form.

*CHARLES.* This accounts for a comparison, which I have frequently heard, of virtue resisting temptation, as gold tried in the fire.

*Mr. HARCOURT.* This power of resisting the action of fire, peculiar to these metals, has given them the denomination of perfect, in opposition to the rest, which are called imperfect, because they are reduced, by being kept long in a fierce fire, to a calx, which you may recollect, is used by the enameller.

*SOPHIA.* Are not metals said to be alloyed, when they are mixed with an inferior kind?

*Mr. HARCOURT.* Yes.—Gold and silver coins are never struck without an alloy of copper. The softness of these metals is the principal reason for their being mixed or alloyed, with design to render them harder. Were not gold so rare, it would be admirable for many domestic utensils, as it never rusts nor tarnishes.

*CECILIA.* Nothing could be so beautiful as gold for such purposes; its brightness, its colour, and cleanliness, to say nothing of its magnificence, would give it a superiority to every other metal. Is this precious substance peculiar to any one part of the globe?

*Mr. HARCOURT.* The knowledge that Charles has acquired of the productions of different countries, will enable him to reply to this question.

*CHARLES.* It is found in all the known parts of the earth, though very unequally with respect to purity and abundance. The most considerable mines in Europe are those of the Upper Hungary, and particularly that of Chremnitz, America yields the greatest profusion of gold of any of the four quarters of the world. Peru, Mexico, Chili, and other provinces of the Spanish West-Indies, to which I may add the Brazils, abound with it. When the Spaniards first visited these countries, they found a temple, the walls of which were covered with gold.

*HENRY.* I wish it were so plentiful in England, we might then use it as commonly as the ordinary metals.

*SOPHIA.* Let us be contented with the use of iron, and the other inferior metals, which are well adapted to most of our domestic wants, without coveting the riches of the Peruvians; to these harmless people, they were a source of the greatest misfortunes.

*AUGUSTA.* How so?—I thought wealth had always been a sign of national prosperity.

*SOPHIA.* You have already forgotten what papa remarked upon that subject, last night, or you would have been of a different opinion. The richness of the Peruvian mines attracted the covetousness of the Spaniards, by whose rapacity their government was subverted, and the whole nation finally destroyed.

*HENRY.* Poverty is then a means of security. Had they been as poor as the Greenlanders, they might have still enjoyed their own territories unmolested. But Charles has not told us which are the other countries where gold is mostly found.

*CHARLES.* In many parts of Asia, especially in Sumatra, Pegu, China, Japan, the Phillipine Islands, and Borneo, it is found in considerable quantities. The coast, as well as the interior parts of Africa, likewise produces a great deal of gold.

*CECILIA.* All gold is not found in mines. I think I have heard, that it is frequently collected from the sand and mud of rivers and torrents.

*Mr. HARCOURT.* This happens more frequently in Guinea than elsewhere. There are many European rivers also which roll particles of gold among their sand. Those rivers yield the greatest plenty whose course is slow and uninterrupted; and where the sand is of a reddish or blackish hue, which, being heavier than the white sand, carries the gold along with it to the bottom. Among the rivers in Europe, which produce gold, are the Rhine, the Rhone, the Garonne, the Danube, and the Elbe. The collection of these scattered grains of this precious metal, affords a bare subsistence to some of the neighbouring inhabitants.

*AUGUSTA.* It must be tedious work to pick it from the sand.

*Mr. HARCOURT.* Experience and ingenuity have invented a more expeditious method than that. The sand is received into a long, sloping trough, lined at the bottom with flannel, or coarse cloth; upon stirring the water about with the hand, the sand is



washed off, and the small particles of gold subside into the woolly matter of the flannel; they are afterwards carefully washed out. Gold is sometimes found, in mines, in small pieces, of different forms and sizes, though but seldom in masses so large as an ounce. At other times, it is dug up in the stony glebes or clods, which are called the mineral, or ore of gold. These clods generally contain a mixture of other metallic matter, particularly silver. They are of various colours, and generally lie at least one hundred and fifty fathoms deep. In order to separate these glebes from the gold they contain, they are at first broken into small pieces with iron mallets, and then carried to the mills, to be ground to a very fine powder, which is infused, in a solution of common salt, in wooden troughs; it is afterwards refined, from the mixture of foreign substances and dross, by mercury.

*Mrs. HARCOURT.* Mercury, or quicksilver, possesses the quality of uniting with the other metals in the form of a paste, which chemists call an amalgam. An amalgam of gold may be procured by heating it red hot, and then pouring heated quicksilver upon it. After which the mixture is to be stirred with an iron rod, till it begins to rise into smoke. To finish the process, it is thrown into a vessel full of water, where it hardens, and becomes fit for use. Gilders and goldsmiths avail themselves of this means, to render gold more applicable to their purposes. Suppose they have occasion to gild a piece of copper, as the lid of a snuff-box, for example, or any other toy, they cover it with a layer of the amalgam, and then place it in a proper vessel over the fire, the quicksilver evaporates by the heat, and the gold only is left upon the surface of the copper.

*SOPHIA.* Knowledge is not only agreeable, but of the greatest utility in the most common arts of life; how long a time it would have cost a person, ignorant of this process, to have gild a button or a thimble!

*Mrs. HARCOURT.* The progress of knowledge is gradual; one discovery leads to another. Without

the advantage of the experiments of others, it is likely, that a man might spend his whole life, without hitting upon the means of effecting a process, which, when known, appears so simple and easy. This art enables goldsmith's to recover the filings and small particles of gold, which accidentally are scattered among the sweepings of their shops.

*AUGUSTA.* The various rich toys in a goldsmith's shop are very amusing. I think it is one of the most elegant of all retail trades.

*Mr. HARCOURT.* To be properly qualified for this business, requires skill in several arts. The accomplished goldsmith should have a good taste for design and sculpture, that he may be able to form his own moulds, and should understand metallurgy, or mixing of metals, sufficiently to give them the proper alloy.

*CHARLES.* I did not know that the metal was cast into the different forms.

*Mr. HARCOURT.* The goldsmith's work is either performed in moulds, or by beating out with the hammer. Works that have raised figures are cast in moulds, and afterwards polished. Plates or dishes, of silver or gold, are beat out from thin plates; and tankards, and other vessels of that kind, are formed of plates soldered together, and their mouldings are the work of the hammer. There is great improvement in the goldsmith's art, for they were obliged formerly to hammer the metal from the ingot to the requisite thinness; but now flattening-mills are used, which reduce metal to the desired thinness at a very small expence.

*CHARLES.* Are there many different kinds of workmen employed by the goldsmith?

*Mr. HARCOURT.* Luxury and opulence occasion so great a demand for the productions of the goldsmith, in the metropolis of a rich commercial nation, as London is, that it encourages many to excel in the different branches of the art, and supplies the artificers with employment, though they may be divided into many kinds; as the jeweller, the snuff-box and

toy-maker, the silver-turner, the gilder, the burnisher, the chaser, the refiner, and the gold-beater. As we have deduced gold from the mine to the hand of the consumer, we will proceed to some particulars relative to silver, if you are not weary, children, of the subject.

*SOPHIA.* I can speak for myself, that I have been so well entertained, I shall be highly gratified by hearing the properties of all the rest of the metals.

*ALL.* We are all of one mind.

*Mr. HARCOURT.* Silver is the most precious, the finest, the purest, and most ductile of all the metals after gold, and possesses many of the same properties, though not in so great a degree: its ductility, or capacity of extension has already been instanced, in the fineness to which the wire is drawn, that is to be covered with gold. It is as fixed and indestructible as gold, bearing the action of fire, without a diminution of its weight. It contracts no rust, but is very apt to tarnish, as you may have often observed. It is harder than gold, and if you take the silver mug, and ring it, you will perceive that it has a sonorous quality. Charles, I shall not infringe upon your office, of pointing out the countries, whose silver mines are the most productive.

*CHARLES.* Every quarter of the globe contains some veins of this metal, nor is our own island destitute of it, for although we cannot boast of any silver mines, properly so called, yet several of our lead-mines yield a considerable proportion of silver. It is said that Sir Hugh Middleton, the projector of bringing the New River from Ware to London, was enabled to prosecute his useful design, by which a great part of the inhabitants of the metropolis is supplied with water, from the silver produced by his lead mines in Wales. The mines of Peru, and other parts of South-America, are much the most abundant of any known; particularly those of Potosi, which continue to repay the labour of the miners, notwithstanding the immense quantities that have been dug out of them. Instead of finding the ore

near the surface, as they formerly did, the workmen are now obliged to descend to prodigious depths, in order to obtain it. So poisonous are the exhalations which issue from them, that many thousands of Indians have perished in them, and prodigious numbers are still sacrificed by avarice there, every year. The cattle which graze upon the outside are affected by the pernicious fumes; but so great is their power over the miners within side, that none of them can resist their influence above a day together. As a means of prevention, these poor people drink an infusion of an herb called paraquay.

*CECILIA.* Our rich sideboards of plate may then be said to be purchased at the price of the health and lives of our fellow creatures.

*MR. HARCOURT.* Mining is in many respects a dangerous and disagreeable employment, but views of present advantage will induce the ignorant and inconsiderate to undertake any task, however objectionable. Silver is found in different states. It is called virgin, or native silver, when it occurs naturally alloyed with copper and gold; but this is but rarely to be met with. When it does happen, it is usually in fibres, grains, or crystallizations, lying in different substances, as flint, spar, slate, &c. but it is generally found in a mineral state, by which I mean, united with matter foreign to itself. Silver is capable of being alloyed with all metals, and forms different compounds with them, according to the nature of the mixture.

*SOPHIA.* Although the exhalations of silver mines are so poisonous, silver is thought the wholesomest of all metals, which is the reason that spoons are generally made of it, and saucepans, where people can afford it. Grand-mamma has one, which she lays aside for the use of any of the family who are indisposed.

*MRS. HARCOURT.* Gilding and silvering are performed by processes very similar to one another, whether on metal, wood, leather, or paper. The method by amalgamation you have already heard.

In many cases the substance intended to be gilt, is daubed over with sizes composed of different materials, and the gold or silver leaf laid upon it.

*HENRY.* O, that was the way my brother used to gild the carp in the fish pond.

*Mrs. HARCOURT.* How was that? Charles, you must tell us your secret.

*CHARLES.* I made a mixture of Burgundy pitch, powdered ember, and several other ingredients, and after rubbing my fish quite dry, I smeared him over with it, and then pressed on the gold leaf gently with my hand; upon which I dismissed my poor prisoner, with his splendid habit, to his native element, better pleased with his release, than with his new finery, which he did not understand.

*Mrs. HARCOURT.* Late as it is, I cannot refuse you the pleasure of hearing a pretty experiment made by an incorporation of aquafortis with silver and mercury, which being put into water, the silver expands, and shoots itself into an appearance of a tree, with branches, leaves, and flowers. This result, chemists distinguish by the name of Arbor Dianæ, or Tree of Diana. It is beyond our usual hour of retirement. Adieu, we will resume the same subject to-morrow.

## CONVERSATION XXVII.

*AUGUSTA.* I THINK you told us, that the experiment which produced the silver tree, was called the Tree of Diana. I can see no reason why it should be appropriated to that goddess.

*Mrs. HARCOURT.* I am glad you have proposed this question, it affords me an opportunity of mentioning the chemical names of the metals, of which you ought not to be ignorant. From what motive it is difficult to say, but chemists have named each of the metals after one of the planets. Thus gold is called Sol, after the sun, perhaps from the brilliancy of its colour. Silver is called Luna, or the moon,

to the beams of which its whiteness bears an allusion, hence the name of this experiment, as Diana was a figurative representation of that planet. Copper is Venus, and iron Mars, which is very suitable, as Mars is the god of War. The activity of Mercury is adapted to quicksilver. Tin is called Jupiter, and lead Saturn.

*CECILIA.* Copper comes next to gold and silver; has it any of their qualities?

*Mr. HARCOURT.* There are some properties common to all metals, which distinguish them from every other substance, and determine them to be metals. By reflection it is likely you will be able to find some of them out.

*SOPHIA.* All the metals that I know are shining, and opaque or solid, without the least degree of transparency, which I suppose is the cause of their reflecting light; and answering, when polished, to the purpose of a mirror.

*CHARLES.* Heaviness is a distinguishing quality, as is also a capacity of being fused or melted by fire; and when hardened again into a solid mass by cold, the facility with which they are expanded under the hammer, must not be forgotten.

*CECILIA.* To which let me add their ductility, or power of being drawn out to such a surprising length.

*HENRY.* You have all omitted saying, that they are found in the bowels of the earth.

*Mr. HARCOURT.* Well remembered, Henry. But to return to the peculiar properties of copper. It is harder than either gold or silver, and is both malleable and ductile, as it may be drawn into a wire as fine as a hair, or beaten into leaves as thin as those of silver. In a great fire, with free access of air, it smokes, loses part of its weight, (for I suppose you recollect that it is an imperfect metal) and imparts beautiful green and blue colours to the flame.

*SOPHIA.* A fire I once saw, made of wood, among which a quantity of copper-dust had been accidentally scattered, shewed all the colours of the rainbow.

*Mr. HARCOURT.* The colour of copper, inclining

to a dullish red, you are all undoubtedly acquainted with. This metal is procured in several parts of Europe, but most abundantly in Sweden. It is found in gleans, or stones of various forms and colours; which are first beaten small, and washed, to separate them from the earthy particles with which they are mixed: after washing they are smelted, and, when in a state of fusion, the melted matter is run into a kind of moulds, by which it is formed into large blocks. The operation of melting is repeated more than once, which, with the addition of a certain proportion of tin and antimony, renders it more pure and beautiful.

*CECILIA.* Is not that green stuff, that is called verdegrease, which I have seen upon dirty sauce-pans, the rust of copper?

*Mrs. HARCOURT.* Yes, my dear. It is so extremely subject to contract rust, being corroded or dissolved by all acids, as well as salts, that I have long disused copper vessels in my kitchen, as being very pernicious to health, unless the most exact nicety be observed in the cleaning them. Many persons have been severely indisposed from the effect of the poison of copper, though it might be expected, that the nauseous taste of the verdegrease would be a warning of the danger. The metal itself, when heated, has both a disagreeable taste and smell.

*HENRY.* You have quite forgotten to mention brass among the metals.

*Mr. HARCOURT.* Brass is a composition of copper, fused with lapis calaminaris, by which it is rendered harder, and becomes of a yellow colour. It is rather lighter, harder, and more sonorous than pure copper, and melts easier; but, if heated even a little, is apt to crack and fall in pieces under the hammer, for which reason it is generally cast into the form required, and polished afterwards. The beauty of its colour, and being less subject to rust than copper, recommend it for the purpose of many domestic utensils. A gold colour may be imparted to brass, by first burning it, then dissolving it in aquafortis, and lastly reducing it to its metalline state: or it may be

whitened, by heating it red hot, and quenching it with water distilled from sal-ammoniac and eggshells.

*CHARLES.* The Corinthian brass was highly valued among the ancients; was that merely a mixture of copper and calimine?

*Mr. HARCOURT.* It is certain, that it was a metallic composition of great beauty, and prized but little below gold: but many doubt the relation of Pliny, who says, that it was a mixture of metals, occasioned by the conflagration of Corinth, when that city was taken by L. Mummius, 146 years before Christ.

*SOPHIA.* Bell-metal bears some resemblance to brass. Is that also a composition?

*Mr. HARCOURT.* It is composed of a due proportion of copper and tin. In the metal of which cannon is made, the copper is mixed with various ingredients of a coarser nature, to make it run close and founder well. Before we dismiss the subject of copper, it may be proper to specify the uses to which it is most commonly applied.

*CHARLES.* As I was passing by a copper-smith's, a little while since, I stood some time, to observe the men at work; they were making large vessels for the purpose of boilers, to which, they told me copper was particularly adapted, from the ease with which it could be hammered out to a proper thinness. There was also a vast number of sheets of copper, prepared for covering the roofs of houses, and sheathing of ships; by this contrivance their holds are defended from worms, and the smoothness of its surface contributes to the swiftness of their sailing.

*CECILIA.* Copper is likewise essential to the engraver. The finest prints are engraved upon sheets of that metal.

*Mrs. HARCOURT.* Perhaps we may enlarge upon that topic at some future opportunity. It is time now to turn our thoughts upon iron, which is the hardest of all metals, and the most extensively useful of any of them; next to gold, it has the greatest tenacity of parts, or difficulty of being broken, is very



elastic, and requires a great degree of heat to put it in a state of fusion. The hardness, brittleness, and capacity of yielding to the hammer, varies in iron, according to the nature of the ore from which it is obtained, and the operation it has undergone. Cast iron is that which is run from the ore, and, from a mixture of crude earth, is so hard, as generally to resist the file or the chissel; it is likewise brittle and unmalleable in this state; but is rendered tough by the operation of forging, which is performed by heating it red hot, and then striking it with large hammers, which force a quantity of vitreous matter out of it. Steel is only a more perfect kind of iron, produced by fusing bars of the purest iron in an earthen crucible, with a cement of charcoal, wood-ashes and different animal substances, such as bones, horns, skins, or hair. The metal, in consequence of this change, acquires a more compact and close-grained texture, and becomes harder, more elastic and tenacious, as well as more fusible. Different degrees of elasticity and brittleness may be given to steel, according to the uses for which it is designed.

*CHARLES.* Papa's sword affords specimens of both qualities: the fine polished handle is very brittle, as he observed when he broke it, by hitting it against a chair, and the blade is so flexible, it will bend almost double without breaking.

*Mr. HARCOURT.* Flexibility is an essential requisite in a sword, for a soldier would presently be exposed to the power of his enemy, whose weapon was easily broken.

*SOPHIA.* Without the elasticity of steel, we should be deprived of the accommodation of watches. I think they are moved by steel springs.

*Mrs. HARCOURT.* Steel watch springs are chiefly made at Geneva by children.

*AUGUSTA.* Pray, what method is taken to give them that blue colour, of which I have frequently seen them?

*Mr. HARCOURT.* Polished plates of steel, put upon a gentle charcoal fire, acquire different colours on

their surfaces, and pass through several shades, according to the degrees of heat; becoming first white, then yellow, orange, purple, violet, and lastly blue. The hardness of steel renders it capable of receiving a sharp edge, which adapts it peculiarly to the blades of all instruments for cutting, such as knives, razors, scissors, &c.

*CECILIA.* Ornamental works of polished steel are extremely beautiful; their brilliancy is exquisite; and I have heard that the workmanship raises them in value to nearly the equivalent of silver or gold.

*Mr. HARCOURT.* Steel is most suitable to all purposes of nicety, where polish or flexibility is requisite; but iron is applicable to some of the most important uses of life, where strength rather than beauty is necessary. Such as anchors, plough-shares, horse-shoes, chains, bars, and nails. Cast iron is used for pots and cauldrons, grates and stoves. Cannon and cannon-balls are also made of it.

*CHARLES.* The uses of iron and steel cannot be enumerated; most tools, both in husbandry and other arts, are made of one or the other. But it has the great defect of being very subject to rust.

*AUGUSTA.* When I was out of health, I was ordered to drink water from a chalybeate spring, which my governess said was impregnated with iron.

*Mrs. HARCOURT.* Water, which imbibes particles of iron as it runs beneath the surface of the earth, is recommended as beneficial in several disorders. Iron is given as a medicine in many forms, and is thought to possess considerable power as a bracer to relaxed habits.

*SOPHIA.* Is not the loadstone a kind of iron?

*Mr. HARCOURT.* It is a species of iron ore, which is both hard and heavy; it possesses extraordinary powers, attracting iron to itself, and communicating this property to any piece of iron that is rubbed with it; but what renders it of most important advantage in civil life, is a peculiar propensity which it has of pointing to the poles of the earth; the ingenuity of man has applied this unaccountable quality to the

construction of the compass, by which ships are guided in their course over the trackless ocean. Iron is the produce of all mountainous countries: the northern parts of Europe supply us with great quantities of this most useful metal. The tops of ferruginous mountains are frequently crowned with resinous trees, such as the pine, the fir, and the cedar, the charcoal of which is particularly adapted to melting the iron. These trees are often covered with mosses, some species of which catch fire from the smallest spark. Thus nature has placed those materials on the same spot, which require the assistance of each other to render them subservient to the uses of man.

*CECILIA.* Although other countries excel Great-Britain in rich mines of gold and silver, she is celebrated for her tin mines. Cornwall and Devonshire abound in this metal, and I have read that the Phœnicians, a people of Asia, traded to this country, for that article, several hundred years before the christian era.

*Mr. HARCOURT.* The application of the information we gain from books on proper occasions, is the best end of reading; for merely turning over a great number of volumes, without increasing our knowledge, is a waste of time. Tin is of a whitish colour softer and less elastic than any other metal. The ore of tin is the heaviest of all metallic ores, though tin is the lightest of metals, which arises from a combination of other substances. When bent, it makes a crackling noise, fuses easily, and calcines, if long exposed to the fire. It possesses the capacity of malleability but not that of ductility.

*Mrs. HARCOURT.* In the Cornish mines large pieces of timber, entire, are sometimes found by the miners at the depth of forty or fifty fathoms; but it is difficult to account how they came there, unless it were at the time of the deluge, or some other violent convulsion of nature.

*AUGUSTA.* Are the uses of tin very considerable?

*Mr. HARCOURT.* The form in which we generally see it, is combined with other metals. Its cleanliness

and freedom from rust are the causes of its being used as a lining to copper vessels, by which means they are rendered safe for the purposes of cooking, &c. The tinned wares, in common use, are plates of iron covered with tin. The plates are first steeped in an acid water, till they are a little corroded; they are then scoured with sand, by which they are made very smooth and fine. Thus prepared, they are dipped into boiling tin, when cooled, they are ready to be formed into various utensils.

*HENRY.* How are they joined together, when they are required to make any thing round, as a mug or a tea-kettle?

*Mr. HARCOURT.* They are soldered with a mixture of tin and lead. A solution of tin in aquaregia, added to the tinctures of cochineal, gum-lac, and some other red tinctures, heightens their colour, and changes it from a crimson, or purple, to a fine scarlet. The superiority of our fine scarlet cloths is attributed to the addition of this ingredient in the dye.

*Mrs. HARCOURT.* Tin is used in the making of looking-glasses, or, at least, in giving them their power of reflection. A sheet of tin foil, made similar to leaf gold, is laid down, perfectly smooth, upon a stone slab, and as much quicksilver poured over it as is sufficient for the glass to swim on, it being previously well cleaned with powdered chalk or whiting; the glass is then covered all over with small leaden weights, to press it down; and the stone is raised at one end for the superfluous quicksilver to drain off; the whole of the tin foil and quicksilver are incorporated, the weights are removed, and the mirror finished. Pins are made of brass wire, and blanchéd or silvered with a preparation of tin.

*CHARLES.* Is not tin an ingredient in pewter?

*Mr. HARCOURT.* Pewter is composed of tin, and other substances mixed with it. It was formerly much used for dishes and plates, but is almost banished by the general use of earthen-ware, which is cleaner and pleasanter in every respect, except that of retaining heat, in which it is excelled by the pewter.

*SOPHIA.* Pewter has a great resemblance to lead, which, I think, is the next of which we are to treat.

*Mr. HARCOURT.* Its colour is a little like it. Lead is a coarse, soft, impure metal, but a very useful one. It is so soft and flexible, that it is easily cut with a knife, shaved with a plane, grooved for windows, by being drawn through the glazier's vice, or flatted into large thin-sheets, by passing it between wooden rollers. It has less malleability than the other metals we have already described; and no capacity of being drawn into wire, which arises from a want of tenacity. Lead is easily fused, and melts long before it becomes red hot: as soon as it becomes fluid, it calcines, and greyish ashes are formed upon its surface. When in a middle state between heat and cold, it is readily formed into small round grains. Thus shot is made of it, by infusing a due proportion of yellow orpiment in it, and then pouring it through a plate of copper, bored with holes, of a suitable size, like a culender, through which the liquid metal passes, and subsides in round balls or grains.

*AUGUSTA.* Pray, what are the compositions which form red and white lead?

*Mr. HARCOURT.* Red lead is a preparation of the metal whose name it bears, by calcination, and long exposure to a strong flame. White lead is formed of its calx, obtained in the fume of vinegar: All acids have the power of dissolving it. This last is of great service to the painters, both in oil and water colours. The discovery of a substitute for it, in house-painting especially, is much to be desired, on account of its extremely pernicious qualities to the health of the workmen who use it. It is also an ingredient in cosmetics, for beautifying the complexion.

*Mrs. HARCOURT.* The custom of painting the face becomes those only, who have effaced the native hues of youth, by late hours and high living, but is entirely inconsistent with purity or simplicity of manners, the most enchanting graces that women can assume. The baneful effects of this dangerous poison are visible in the countenances of those who make

use of it, by their haggard looks and premature old age.

*Mr. HARCOURT.* Lead is used in paintings with oil, not only as a colour, but as a dryer. It is likewise serviceable in assisting the melting of enamels and porcelain, and is the general basis of the glazing of pottery wares. The refiner finds it of great benefit in cleansing and assaying the most perfect metals.

*HENRY.* Lead seems to be a very useful metal ; I know of several purposes to which it is applied.

*Mr. HARCOURT.* It is also subject to be abused, its poisonous quality rendering it highly dangerous to be taken internally, unless regulated by the judgment of a skilful physician. Avarice has induced some unprincipled persons to infuse salt of lead into wine turned sour, with design to recover it. Lead is administered externally for wounds and ulcers ; and Goulard, so much approved for its efficacy in inflammation, is prepared from the extract of lead. Now, Henry, favour us with what you have observed upon the subject.

*HENRY.* Houses are covered with lead ; gutters, pipes, and cisterns are made of it ; but I do not know how it is formed into sheets for these uses.

*Mr. HARCOURT.* Large blocks, called pigs of lead, furnished from the lead works, are melted by the plumbers into shapes, by running the metal, when liquid, into moulds of brass, clay, or plaster. The lead, intended for large sheets to cover the roofs of houses and churches, is melted in a huge cauldron or furnace, and poured with ladles upon a table of extensive dimensions, covered with fine sand, and guarded with ledges. Pipes are sometimes cast, at others they are made of a flat piece rolled round, and soldered together.

*CHARLES.* Lead is found in various countries, but it abounds particularly in England. Cornwall, Devonshire, and Somersetshire, yield a considerable quantity. Nor are our mines confined to the West ; Derbyshire, Northumberland, and Durham, boast

of some which are valuable. Wales likewise is very productive in this article. So poisonous is the quality of the ore, that in the neighbourhood where it is dug, neither cat, dog, nor fowl can be kept. Silver is mostly found mixed with it, but often in such small proportions as not to repay the expence of separating it.

*CECILIA.* Is the black lead, of which pencils are made, composed of that metal?

*Mrs. HAREOURT.* That substance, for it is not a metal, is produced in England, particularly in Cumberland. For the purpose of making it into pencils, it is sawed into slips, and fitted into a groove of some soft wood, like cedar; and another slip of wood, glued over them. I cannot dismiss our subject without remarking the abundance and variety of materials which nature offers to her children, as objects for the exercise of their understandings and industry. The globe is covered with vegetation; the ocean abounds with treasure; animals of every order fill the air and inhabit the earth, whilst its bowels conceal the riches of the mine; but to the uncivilized savage the principal part of these gifts are useless. The exertion of the intellectual faculties, application, ingenuity, and the multiplied wants of refined society are requisite to apply them to beneficial purposes. The gradations of being, from a polype to a man, are numerous; the distinctions between a savage and a philosopher are likewise great, though individuals of the same species. The advantage we enjoy of being born in a state of civilization, enables us to aspire to a degree of improvement, characteristic of the latter. Do not let us be deprived of this superiority by sloth or inattention, but by a daily exertion of the talents bestowed upon us, let each of us endeavour to acquire useful knowledge, which is at once the ornament and companion of virtue.

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